CALIFORNIA HIGH-SPEED TRAIN

Project Environmental Impact Report/Environmental Impact Statement

SUPPLEMENTAL

Alternatives Analysis Report

for the

San Francisco to San Jose Section

August 2010

California High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

California High-Speed Train Project

San Francisco to San Jose Section Project EIR/EIS

SUPPLEMENTAL ALTERNATIVES ANALYSIS REPORT

August 2010

Public Comment on Supplemental Alternatives Analysis Report

Comments should be directed to:

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Attn: San Francisco to San Jose Section Supplemental Alternatives Analysis Report Comments

Comments can be received by the Authority through regular U.S. mail, via email with the subject line “San Francisco to San Jose Section Supplemental Alternatives Analysis Report Comments” sent to comments@hsr.ca.gov, or by facsimile transmission to (916) 322-0827.

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ABBREVIATIONS / ACRONYMS

AA	Alternative Analysis
AASHTO	American Association of State Highway and Transportation Officials
ACE	Altamont Commuter Express
Amtrak	National Railroad Passenger Corporation
Authority	California High-Speed Rail Authority
BATA	Bay Area Toll Authority
BNSF	Burlington Northern Santa Fe
CalTrain	Peninsula Corridors Joint Powers Board
Caltrans	California Department of Transportation
Capitols	Capitol Corridor Joint Powers Board
CEQA	California Environmental Quality Act
CHRIS	California Historical Resources Information System
CNG	Compressed Natural Gas
CSS	Context Sensitive Solutions
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMU	Electric Multiple Units
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global Positioning System
HOT	High-Occupancy Toll
HOV	High Occupancy Vehicle
HST	High-Speed Train
I	Interstate Route
KOP	Key Observation Point
LOS	Level of Service
LRT	Light Rail Transit
MOA	Memorandum of Agreement
MP	Mile Post
MPH	Miles per Hour
MT2	MAIN TRACK #2
MTC	Metropolitan Transportation Commission
MUNI	San Francisco Municipal Transportation
NEPA	National Environmental PoLICY Act
NRHP	National Register of Historic Places
PCJPB	Peninsula Corridor Joint Powers Board (Caltrain)
PMT	Program Management Team
PWG	PolicyMaker Working GrOUP
ROW	Right-of-Way
RRC	Regional Rebuild Center
RTP	Regional Transportation Plan
Samtrans	San Mateo County Transit District
Section 4(f)	Section 4(f) OF THE U.S. Department of Transporation Act of 1966
SFO	San Francisco International Airport
SJC	Mineta San Jose International Airport
SJRRC	San Joaquin Regional Rail Commission
SR	State Route
STIP	State Transportation IMPROVEMENT Program
TCE	Temporary Construction Easement
TJPA	Transbay Joint Powers Authority
TOD	Transit-Oriented Development
TOR	TOP OF RAIL
TTC	Transbay Transit Center
TWG	Technical Working Group
UP	Union Pacific RAILROAD
USGS	United States Geological Survey
VTA	Santa Clara Valley Transportation Authority
YOR	YEAR OF EXPENDITURE

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Summary

This section has been modified to read as follows:

S.1 Results from the Supplemental Alternatives Analysis

The August 2010 San Francisco to San Jose (SF to SJ) Supplemental Alternatives Analysis (AA) Report updates the Preliminary AA Report that the California High Speed Rail Authority (Authority) issued for the SF to SJ high-speed train (HST) section in April 2010. Modifications are being recommended to the alternatives and design options described in the Preliminary AA Report based on consultation with local cities and agencies and additional engineering and environmental detail that has become available. The Supplemental AA Report presents the changes from the earlier Preliminary AA Report, while referencing the previous material and text that has not changed. These recommendations are based on information developed to date and present concepts that will continue to be refined and will be analyzed during the preparation of the Draft EIR/EIS.

Alternatives Recommended to be Carried Forward in 2010 Preliminary AA Report

The Preliminary AA Report recommended that a variety of vertical options for the Caltrain corridor be further evaluated as part of the on-going engineering and environmental process. HST stations locations were identified at San Francisco (a joint terminal solution at Transbay Transit Center and 4th and King), Millbrae and San Jose, with a potential Mid-Peninsula station located at either Redwood City, Palo Alto or Mountain View. Generally, the HST Alternative would require four tracks for HST and Caltrain service in the Caltrain corridor. A number of design options were recommended to be examined throughout the length of the corridor.

Design Options Recommended to be Carried Forward in Supplemental AA Report and Project EIR/EIS

This August 2010 Supplemental AA Report identifies two basic design options to be examined in the Draft EIR/EIS. These two options represent "stitched together" alignments that would result in a four track, fully grade separated railroad serving both HST and Caltrain between Transbay Transit Center and 4th and King in San Francisco and San Jose Diridon Station in San Jose. These design options were developed considering the following goals:

1. **Constructability:** Use uniform structure types that are well known in the rail industry and can be applied uniformly throughout the corridor
2. **Minimize Displacements:** Employ the narrowest track configuration to minimize ROW requirements
3. **Minimize disruption to the Caltrain system during construction:** Use three basic structure typologies (at-grade, aerial and trench) that can be constructed and staged in a way to that allows Caltrain to continue in operation during construction.
4. **Minimizes construction costs:** Develop Design Options A and B to minimize construction costs of the Statewide High Speed Train System while delivering a four track, interoperable, grade separated railroad that can be shared by HST and Caltrain.
5. **Meet community needs:** Address city and public interest in alternatives that would not visually divide communities and are responsive to concerns regarding potential noise and vibration impacts.

In the community meetings there was significant interest in design options (hybrid configurations) that stack two tracks over two tracks in either combinations of tunnels and trenches, or in deep trenches that could also act as tunnels for high speed trains on the lower level and a trench for Caltrain and freight service on the upper level. The perceived advantage of these alternatives was that they had a narrow footprint (66-70 feet wide) and would be appropriate in those areas where the existing Caltrain right of way is particularly narrow. The design team looked into applying this type of solution but found that it had the following shortcomings:

- In order to change from a four-track parallel configuration to the four-track stacked configuration, a 5000-foot long transition segment is required. In this transition segment, the "weaving" structures needed to move two tracks from a side-by-side to a stacked configuration require right-of-way approximately 120-135 feet wide. For each stacked segment, two of these 5000-foot long transition segments are required, one to the north and one to the south of the stacked area. Combined, these two transition segments would create about 2 miles of alignment that would most likely have adverse affects on permanent right of way needs. Operational flexibility on the corridor would be limited in the stacked areas. Trains would be limited to either the Caltrain or HST tracks for the length of the configuration (ranging from 3-6 miles) with no opportunity for connection.
- Constructability would be difficult for the deep trench alternative. It would require a 70-80 foot deep trench to be built for HST at the lower level and then an intermediate floor would need to be built to support the Caltrain and freight trains at the upper level. This would be difficult and very expensive to build.

Maintenance Facility

Initially, there were three potential maintenance facility sites identified for consideration at: the Port of San Francisco Piers 90-94, San Francisco International Airport and a site in the Bayshore / Brisbane area.

Port Of San Francisco: The Port site was not studied further because it was too small and difficult to access from the Caltrain mainline in the vicinity of the Quint Street lead. The facility would need to be "stub ended" which is not ideal for operations. In order to accommodate the forecasted storage needs for San Francisco, it would most likely need to be two levels to accommodate both the maintenance and storage functions at the site which would be difficult to construct and costly. For these reasons this site is not recommended for study in the EIR/EIS.

San Francisco International Airport (SFO): The SFO site would have provided adequate space (100 acres) however it too would have been stub ended. It also would be difficult to access from the Caltrain mainline and would possibly require modifications to the Hwy 101 interchange. After meeting with staff at SFO, it was determined that the site was not available as the lease to the site had been renewed with the current tenants. Consequently the site is not recommended for study in the EIR/EIS.

Brisbane / Bayshore: The Brisbane site would provide adequate space (100 acres) for maintenance and storage for the high speed train uses. There is adequate space to design a facility with a loop track which would provide operational feasibility for a maintenance facility. The site has good access from the Caltrain mainline tracks and allows for both southbound and northbound access. For these reasons, the Brisbane / Bayshore site should be carried forward for study in the EIR/EIS. The city is currently evaluating other land use plans for this area and the Authority would work closely with the city to review a proposed maintenance facility and seek a site that is complementary to City's vision.

Design Option A

Design Option A includes predominantly at-grade and aerial structure options to travel the length of the San Francisco to San Jose corridor. A summary of the subsection options studied as part of this design option is presented in Table S-1 and shown in Figure S-1, with the table listing whether or not they are recommended to be carried forward for analysis in the Draft EIR/EIS. The vertical options with a grey box and the letter "A" in them would be carried forward; those which are blank would not be carried forward. Where two grey boxes with the letter "A" appear in one subsection, this denotes a configuration where some tracks would be in the first vertical option and the other tracks would be in the second vertical option.

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Table S-1
Design Option A – Subsection Options Carried Forward

City or Town	Sub-section	Vertical Options Carried Forward						
		Location	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
San Francisco	0(a)	HST and Caltrain to both Transbay and 4th & King			4th and King		TTC	
	1A	North of Mission Bay Drive to South of 16th Street			A[1]		A	
	1B-1C	South of 16th Street to North of Cesar Chavez Street			A		A	
	1D-1G	North of Cesar Chavez Street to South Portal Tunnel No. 4			A		A	
South San Francisco	2A	South Portal Tunnel No. 4 to south of Colma Creek			A			
South San Francisco / San Bruno	2B	South of Colma Creek to south of I-380		A				
San Bruno	2C(1)	South of I-380 to south of Angus Avenue		A				
	2C(2)	South of Angus Avenue to south of Center Street		A		A		
Millbrae / Burlingame	2D	South of Center Street to south of Millbrae Avenue			A		A	
Burlingame / San Mateo	3A	South of Millbrae Avenue to south of Mills Creek	A					
	3B	South of Mills Creek to north of Villa Terrace	A					
San Mateo	3C-3D	North of Villa Terrace to north of Hayward Park Station	A					
	3E	North of Hayward Park Station to north of Highway 92			A			
	4A	North of Highway 92 to south of 25th Avenue		A				
	4B(1)	South of 25th Avenue to 42nd Avenue		A				
Belmont / San Carlos	4B(2)	42nd Avenue to south of Cordilleras Creek	A					
Redwood City	4C	South of Cordilleras Creek to north of Woodside Road	A					
San Mateo County (North Fair Oaks)	4D	North of Woodside Road to north of 5th Avenue			A			
	5A	North of 5th Avenue to south of 5th Avenue			A			
Atherton / Menlo Park	5B	South of 5th Avenue to south of Ravenswood Avenue	A					

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City or Town	Sub-section	Vertical Options Carried Forward						
		Location	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
	5C	South of Ravenswood Avenue to north of San Mateo County/Santa Clara County Line			**A**			
Palo Alto	**6A**	North of San Mateo County/Santa Clara County Line to south of Embarcadero Road			**A**			
	6B	South of Embarcadero Road to south of Churchill Avenue	**A**					
	6C	South of Churchill Avenue to north of East Meadow Drive			**A**			
	6D	North of East Meadow Drive to north of Adobe Creek	**A**					
Mountain View	**7A**	North of Adobe Creek to north of Rengstorff Avenue			**A**			
	7B	North of Rengstorff Avenue to north of Stevens Creek			**A**			
	7C	North of Stevens Creek to south of Route 237			**A**			
Sunnyvale / Santa Clara	**7D(1)**	South of Route 237 to north of Mathilda Avenue	**A**					
	7D(2)	North of Mathilda Avenue to north of Fair Oaks Avenue			**A**			
	8A(1)	North of Fair Oaks Avenue to south of Lawrence Expressway			**A**			
	8A(2)	South of Lawrence Expressway to south of Scott Boulevard	**HST Only A**					
Santa Clara	**8B**	South of Scott Boulevard to north of De La Cruz Boulevard	**HST Only A**					
	9A	North of De La Cruz Boulevard to South of Taylor Street	**HST Only A[2]**					
San Jose	**9B**	South of Taylor Street to Diridon Station	**HST Only A**					

1=1A-1G Assumes use of existing Caltrain tunnels

2=9A and 9B an additional aerial alignment was identified during the Preliminary AA review process that moves the horizontal alignment east, away from residential neighborhoods.

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San Francisco
Station
Transbay
Transit Center

San Francisco
Station
4th & King

Millbrae (SFO)
Station

Potential
Mid-Peninsula
Station Location
Redwood City

Potential
Mid-Peninsula
Station Location
Palo Alto

Potential
Mid-Peninsula
Station Location
Mountain View

San Jose
Diridon Station

9(a) Option Only

LEGEND:

- AERIAL VIADUCT (HST Only)
- AERIAL VIADUCT/BERM
- AT GRADE
- OPEN TRENCH
- COVERED TRENCH/TUNNEL
- DEEP TUNNEL (HST Only)
- 0 SUBSECTION NUMBER / LIMITS

SAN FRANCISCO TO SAN JOSE SECTION

Figure S-1

DESIGN OPTION A

Design Option B

Design Option B and sub-option B1 would include at-grade, aerial, trench and tunnel designs to travel the length of the San Francisco to San Jose corridor. In the southern part of the corridor (Palo Alto, Mountain View and Sunnyvale), Design Option B alternates between trench, at-grade, and aerial options. Sub-option B1 essentially continues the trench in subsections where Design Option B would bring the four track system back to grade or elevated. A summary of the subsection options studied as part of this design option is presented in Table S-2 and shown in Figures S-2 and S-3, with the table listing whether or not they are recommended to be carried forward for analysis in the Draft EIR/EIS. The vertical options with a grey box and the letter "B or B1" in them would be carried forward, those which are blank would not be carried forward. Where two grey boxes with the letter "B" appear in one subsection, this denotes a configuration where some tracks will be in the first vertical option and the other tracks will be in the second vertical option.

Partially or completely covered trench or short tunnel sections may be proposed to ameliorate either narrow right of way or environmental concerns on the alignment between San Francisco and San Jose. The downtown San Mateo area is one potential location for consideration of partial or full coverage of the trench to replace an existing street. The San Francisquito Creek in Palo Alto could be a location where a short tunnel underneath the creek would be necessary in order to not interfere with the creek's water flow. In other sections of the system, to the extent feasible, the trench would be designed to not preclude future decking or coverage. This would allow cities to cover sections of the trench if they found it desirable and if it were acceptable by Caltrain and the Authority. Covered sections of less than 600 feet in length could be added at a later date without requiring substantial re-design and added features.

Table S-2
Design Option B and Sub-Option B1 – Subsection Options Carried Forward

City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
San Francisco	0(a)	HST and Caltrain to both Transbay and 4th & King			4th and King		TTC	
	1A	North of Mission Bay Drive to South of 16th Street			B[1]		B	
	1B-1C	South of 16th Street to North of Cesar Chavez Street			B		B	
	1D-1G	North of Cesar Chavez Street to South Portal			B		B	
		Tunnel No. 4						
South San Francisco	2A	South Portal Tunnel No. 4 to south of Colma Creek			B			
South San Francisco / San Bruno	2B	South of Colma Creek to south of I-380		B				
San Bruno	2C(1)	South of I-380 to south of Angus Avenue		B				
	2C(2)	South of Angus Avenue to south of Center Street		B		B		
Millbrae / Burlingame	2D	South of Center Street to south of Millbrae Avenue			B		B	
Burlingame / San Mateo	3A	South of Millbrae Avenue to south of Mills Creek				B		
	3B	South of Mills Creek to north of Villa Terrace				B		
San Mateo	3C-3D	North of Villa Terrace to north of Hayward Park Station				B		
	3E	North of Hayward Park Station to north of Highway 92			B			
	4A	North of Highway 92 to south of 25th		B				

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City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
		Avenue						
	4B(1)	South of 25th Avenue to 42nd Avenue		**B**				
Belmont / San Carlos	**4B(2)**	42nd Avenue to south of Cordilleras Creek	**B**					
Redwood City	**4C**	South of Cordilleras Creek to north of Woodside Road	**B**					
San Mateo County (North Fair Oaks)	**4D**	North of Woodside Road to north of 5th Avenue			**B**			
	5A	North of 5th Avenue to south of 5th Avenue			**B**			
Atherton / Menlo Park	**5B**	South of 5th Avenue to south of Ravenswood Avenue				**B**		
	5C	South of Ravenswood Avenue to north of San Mateo County/Santa Clara County Line				**B**		
Palo Alto	**6A**	North of San Mateo County/Santa Clara County Line to south of Embarcadero				**B**		

City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
		Road						
	6B	South of Embarcadero Road to south of Churchill Avenue				**B**		
	6C	South of Churchill Avenue to north of East Meadow Drive			**B**	**B1**		
	6D	North of East Meadow Drive to north of Adobe Creek	**B**			**B1**		
Mountain View	**7A**	North of Adobe Creek to north of Rengstorff Avenue			**B**	**B1**		
	7B	North of Rengstorff Avenue to north of Stevens Creek				**B**		
	7C	North of Stevens Creek to south of Route 237			**B**	**B1**		
Sunnyvale / Santa Clara	**7D(1)**	South of Route 237 to north of Mathilda Avenue	**B**			**B1**		
	7D(2)	North of Mathilda Avenue to north of Fair Oaks Avenue			**B**	**B1**		
	8A(1)	North of Fair Oaks Avenue to			**B**			

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City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
		south of Lawrence Expressway						
	8A(2)	South of Lawrence Expressway to south of Scott Boulevard			B			
Santa Clara	8B	South of Scott Boulevard to north of De La Cruz Boulevard	HST Only B					HST Only B1
	9A	North of De La Cruz Boulevard to South of Taylor Street	HST Only B[2]					HST Only B1
San Jose	9B	South of Taylor Street to Diridon Station	HST Only B					

1=1A-1G Assumes use of existing Caltrain tunnels

2=9A and 9B an additional aerial alignment was identified during the Preliminary AA process that moves alignment east, away from residential neighborhoods.

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San Francisco
Station
Transbay
Transit Center

San Francisco
Station
4th & King

Millbrae (SFO)
Station

Potential
Mid-Peninsula
Station Location
Redwood City

Potential
Mid-Peninsula
Station Location
Palo Alto

Potential
Mid-Peninsula
Station Location
Mountain View

San Jose
Diridon Station

9(a) Option Only

LEGEND:

- AERIAL VIADUCT (HST Only)
- AERIAL VIADUCT/BERM
- AT GRADE
- OPEN TRENCH
- COVERED TRENCH/TUNNEL
- DEEP TUNNEL (HST Only)
- 0 SUBSECTION NUMBER / LIMITS

SAN FRANCISCO TO SAN JOSE SECTION

Figure S-2

DESIGN OPTION B

San Francisco
Station
Transbay
Transit Center

San Francisco
Station
4th & King

Millbrae (SFO)
Station

Potential
Mid-Peninsula
Station Location
Redwood City

Potential
Mid-Peninsula
Station Location
Palo Alto

Potential
Mid-Peninsula
Station Location
Mountain View

San Jose
Diridon Station

9(a) Option Only

LEGEND:

- AERIAL VIADUCT (HST Only)
- AERIAL VIADUCT/BERM
- AT GRADE
- OPEN TRENCH
- COVERED TRENCH/TUNNEL
- DEEP TUNNEL (HST Only)
- 0 SUBSECTION NUMBER / LIMITS

SAN FRANCISCO TO SAN JOSE SECTION

Figure S-3

Design Option B1

Track Configuration

The Supplemental AA Report recommends that the design and environmental efforts focus on a horizontal track configuration that has Caltrain predominantly operating on the outside two tracks and HST on the inside two tracks (see figure S-4). This configuration is recommended primarily because it requires significantly less (approximately 20% less) right of way than having both Caltrain tracks on one side of the corridor (see figure S-5). This reduced need for ROW would be particularly significant where Caltrain stations are close together (approximately a mile apart) and there is insufficient distance to narrow the ROW width between stations. This configuration also allows greater flexibility in coordinating schedules and sharing track capacity on the corridor for the reason that it would allow HST trains overtake other trains in certain areas without crossing opposing rail traffic.

Figure S-4
Typical Track Configuration to be Carried Forward in the EIR/EIS

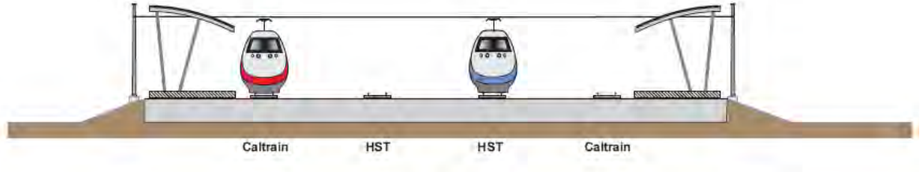
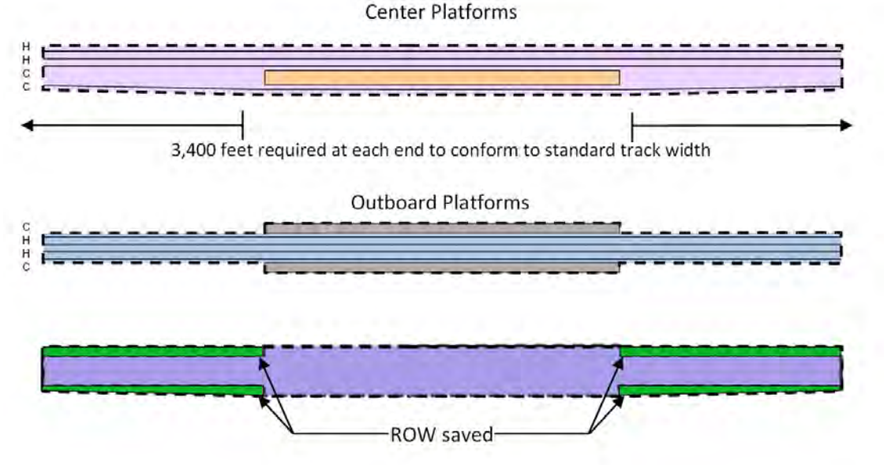


Figure S-5
Potential ROW Saving with Outboard Platform Track Configuration



S.2 Alternatives Analysis Evaluation Measures

The alignment alternatives, station location and design options recommended to be carried forward into the detailed alternatives analysis were assessed for each of the project objectives and evaluation measures. This preliminary information was then used to evaluate which alternatives are potentially feasible and practicable and are recommended for preliminary engineering design and environmental review as part of the EIR/EIS. The primary evaluation measures are listed below.

- Design objectives (including measures such as travel time and cost)
- Land use (including measures such as consistency with land use and general plans)
- Constructability (including measures such as track type construction and access to the corridor)
- Community impacts (including measures such as amount of land acquisition)
- Natural resources (including measures such as impacts to wetlands, potential threatened and endangered species habitat, and other resources)
- Environmental quality (including measures such as number of sensitive noise receptors)
- Additional considerations (including measures such as ability to meet project purpose and support by public and agencies)

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S.3 San Francisco to San Jose Section HST Project Background

The San Francisco to San Jose HST Section is a critical link in Phase 1 of the HST System. The Caltrain Corridor route of the San Francisco to San Jose Section was analyzed, evaluated and selected in the 2005 Final Program EIR/EIS for the Proposed California High-Speed Train System (referred to hereafter as the Statewide Program EIR/EIS) and again in the 2008 Bay Area to Central Valley HST Final Program EIR/EIS (referred to hereafter as the Bay Area to Central Valley Program EIR/EIS).

Stations will be located in the City of San Francisco at the Transbay Terminal; in the City of Millbrae at the existing Millbrae BART/Caltrain station; and in the City of San Jose at the Intermodal Diridon station. One potential mid-peninsula station stop is also under consideration. Alternative locations being reviewed for this potential stop are in the City of Redwood City at the existing downtown Caltrain station; in the City of Palo Alto at the existing Caltrain station; and in the City of Mountain View at the existing Caltrain/VTA LRT station.

The Bay Area to Central Valley Program EIR was the subject of a lawsuit filed by the Town of Atherton and others in August 2008. In November 2009, the court issued its decision in the case. The court concluded that the EIR complied with CEQA in most respects, including its analysis of alternatives and its analysis of impacts and mitigation in the areas of biology, noise, aesthetics, growth and heritage trees. However, the court indicated that the EIR required corrective work and recirculation for certain issues regarding the segment between San Jose and Gilroy. In accordance with the court decision, the Authority has rescinded its resolution certifying the Bay Area Program EIR and is preparing revisions to the Program EIR identified by the court. On March 11, 2010, the Authority began circulating Revised Draft Program EIR Material for public review and comment prior to the Authority's consideration of the revised Program EIR. It is expected that the Authority will recertify the Program Level document in the fall of 2010.

Pre-scoping public outreach activities for the San Francisco to San Jose EIR/EIS were initiated in December 2008. Public scoping meetings were held in January 2009, and information meetings were held at the proposed/potential HST station locations. After the scoping period ended, an initial range of alternatives for the San Francisco to San Jose Section was developed. Because the Caltrain corridor is constrained by development on both sides, the alignment alternatives available are predominately vertical options. In fall 2009, the initial alternatives were presented to the Technical Working Groups and Policy Working Group. In addition, three public workshops were held, and the regional team met with the staff of each City along the corridor to review the options. See Section 3.3.2 and Appendix F of the Preliminary and Supplemental AA for further details regarding agency coordination and public outreach.

S.4 Public and Agency Outreach Efforts with the Preliminary Alternatives Analysis

Since the publication of the Preliminary AA on April 8, 2010, a series of 32 meetings and workshops, with a total of more than 1,500 participants, were held along the corridor to inform the public and gather comments on the Preliminary Alternatives Analysis Report. Meetings were noticed online at the CHSRA website Calendar, on the Peninsula Rail Program website, and on the websites of local communities, via e-blasts utilizing the project email database, as well as through mailings and other notices in partnership with local communities. The following is a summary of the feedback received from the public:

- There was concern about potential impacts to properties along the right of way, especially in those areas where the right of way is narrow.
- There was concern about the potential noise and visual impacts generated by the project, especially as it relates to above-grade alternatives.
- Many comments expressed a general preference for below-grade alternatives. Several communities asked that below-grade options be added for further consideration.
- There was a request to minimize the use of elevated retained fill berms.
- There were concerns about the overall cost of the system.

S.5 Next Steps

The Preliminary and Supplemental AA Reports will inform the Project Description for the Project EIR/EIS. They will also focus the next level of design (15 percent) and inform the analysis of environmental impacts. This ongoing work will provide the Authority, FRA and the communities in the Caltrain corridor a fuller picture of the design options in each subsection and a comprehensive review of the project's benefits and impacts.

As the engineering and environmental work continues, the Authority will continue to meet and engage communities along the San Francisco to San Jose HST section in a discussion about the different alternatives. These activities will inform preparation of the Draft Project EIR/EIS, which is currently scheduled to be released for public comment in December of 2010.

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1.0 Introduction

No modifications or updates to this section.

1.1 California HST Project Background

No modifications or updates to this section.

1.2 San Francisco to San Jose EIR/EIS Background

The first paragraph of this section has been modified to read as follows:

The San Francisco to San Jose HST Section is part of Phase 1 of the HST System, which will provide service between San Francisco, Los Angeles and Anaheim. The Caltrain Corridor route of the San Francisco to San Jose section was analyzed, evaluated and selected for further study in the 2005 Final Program EIR/EIS for the Proposed California High-Speed Train System (referred to hereafter as the Statewide Program EIR/EIS) and again in the 2008 Bay Area to Central Valley HST Final Program EIR/EIS (referred to hereafter as the Bay Area to Central Valley Program EIR/EIS). As a result of the Superior Court's Ruling in *Town of Atherton, et al., v. California High Speed Rail Authority,* the Authority has rescinded its certification of and decisions on the Bay Area to Central Valley HST Final Program EIR/EIS, is doing additional work on that Program EIR, and is expected to consider whether to certify a revised Final EIR and to make new decisions concerning this document in the fall of 2010.

There are no changes to the remainder of this section.

1.3 Study Area

No modifications or updates to this section.

1.4 Purpose of Study

This section has been modified to read as follows:

The August 2010 San Francisco to San Jose (SF to SJ) Supplemental Alternatives Analysis (AA) Report updates the Preliminary AA Report that the California High Speed Rail Authority (Authority) issued for the SF to SJ high-speed train (HST) section in April 2010. Modifications are being recommended for the alternatives and design options described in the Preliminary AA Report based on consultation with local cities and agencies and additional engineering and environmental detail that has become available. The Supplemental AA Report presents the changes from the earlier Preliminary AA Report, while referencing the previous material and text that has not changed.

1.5 Organization of Report

No modifications or updates to this section.

1.6 Context Sensitive Solutions

No modifications or updates to this section.

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2.0 Alternatives Development Process

No modifications or updates to this section.

2.1 HST Project Purpose

No modifications or updates to this section.

2.1.1 Objectives of the Statewide HST System and within the San Francisco to San Jose Region

No modifications or updates to this section.

2.2 Identification of Alternatives to be Carried Forward

No modifications or updates to this section.

2.3 HST Design Objectives

No modifications or updates to this section.

2.4 Comparison of Project Alternatives

No modifications or updates to this section.

2.5 Context Sensitive Solutions (CSS)

No modifications or updates to this section.

3.0 Alternatives

No modifications or updates to this section.

3.1 No Project Alternative

No modifications or updates to this section.

3.1.1 Conventional Passenger Rail Element

No modifications or updates to this section.

3.1.2 Highway Element

No modifications or updates to this section.

3.1.3 Transit Element

No modifications or updates to this section.

3.1.4 Aviation Element

No modifications or updates to this section.

3.2 Program Level Alternatives

No modifications or updates to this section.

3.2.1 San Francisco to San Jose Routing Alternatives

No modifications or updates to this section.

3.2.2 Station Alternatives

No modifications or updates to this section.

3.3 Initial Identification of Project Alternatives

No modifications or updates to this section.

3.3.1 Alternatives Considered and Rejected

No modifications or updates to this section.

3.3.2 Development of Options for the Caltrain Shared Use Corridor

No modifications or updates to this section.

3.3.3 Initial Review of Vertical Alignment Options

No modifications or updates to this section.

3.3.4 Agency Coordination and Public Outreach

Appendix F has been modified. No other modifications or updates to this section.

3.3.5 Options Carried Forward and Not Carried Forward into Detailed Evaluation

No modifications or updates to this section.

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4.0 Development and Evaluation of Project Alternatives

No modifications or updates to this section.

4.1 Description of Alternatives

No modifications or updates to this section.

4.1.1 Definition of Vertical Options

The highlighted text below was modified:

- Below Grade
    - Deep Tunnel – typically a bored tunnel with ventilation shafts spaced appropriately.

The following text was added:

- Hybrid
    - Aerial/Trench – typically a 2-track concrete structure (viaduct) supported by columns combined with a 2-track open trench. This configuration would be used in the same conditions as the aerial viaduct and open trench to minimize the ROW width required. The hybrid configuration would transition to elevated, at-grade, and below grade options where sufficient ROW width was available or at locations to allow for interoperability between the HST and Caltrain services.
    - Trench/Box – typically a 2-track open trench combined with a 2-track covered trench below the open trench. This configuration would be used in the same conditions as the open trench and covered trench to minimize the ROW width required. The hybrid configuration would transition to elevated, at-grade, and below grade options where sufficient ROW width was available or at locations to allow for interoperability between the HST and Caltrain services.
    - Trench/Tunnel – typically a 2-track open trench combined with a bored tunnel (single, 2-track large diameter tunnel or twin, single-track small diameter tunnels). This configuration would be used in the same conditions as the open trench and covered trench to minimize the ROW width required. The hybrid configuration would transition to elevated, at-grade, and below grade options where sufficient ROW width was available or at locations to allow for interoperability between the HST and Caltrain services.

4.1.2 Train Operations and Arrangement of Tracks and Station Platforms

The highlighted text below was modified:

- Overtakes (an overtake is one train passing another travelling in the same direcrtion)
    - ~~It is currently assumed in the Phase 1 Operating Plan that the HST has no scheduled overtakes between San Francisco and Gilroy.~~
    - It is currently assumed in the integrated operating plan for both HST and Caltrain train services that Caltrain could have scheduled overtakes between San Francisco and San Jose.

The following section was added:

4.1.3 Maintenance Facility

The Maintenance Facility (Level 3) to support the San Francisco to San Jose section requires a site of approximately 100 acres and would provide for light maintenance (daily inspections, minor maintenance, cleaning, etc) and storage for staging of rolling stock starting from San Francisco (see Appendix M). It would have direct rail connections to the mainline from both the north and the south. There would be approximately 1050 parking spaces. Initially, there were three potential maintenance facility sites identified for consideration at: the Port of San Francisco Piers 90-94, San Francisco International Airport and a site in the Bayshore / Brisbane area.

Port Of San Francisco: The Port site was not studied further because it was too small and difficult to access from the Caltrain mainline in the vicinity of the Quint Street lead. The facility would need to be "stub ended" which is not ideal for operations. In order to accommodate the forecasted storage needs for San Francisco, it would most likely need to be two levels to accommodate both the maintenance and storage functions at the site which would be difficult to construct and costly. For these reasons this site is not recommended for study in the EIR/EIS.

San Francisco International Airport (SFO): The SFO site would have provided adequate space (100 acres) however it too would have been stub ended. It also would be difficult to access from the mainline and would possibly require modifications to the Hwy 101/I-380 interchange. After meeting with staff at SFO, it was determined that the site was not available as the lease to the site had been renewed with the current tenants. For these reasons this site is not recommended for study in the EIR/EIS.

Brisbane / Bayshore: The Brisbane site would provide adequate space (100 acres) for maintenance and storage for the high speed train uses. There is adequate space to design a facility with a loop track which would be able to provide operational feasibility for a maintenance facility. The site has good access from the mainline tracks and allows for both southbound and northbound access. For these reasons, the Brisbane / Bayshore site should be carried forward for study in the EIR/EIS. The city is currently evaluating other land use plans for this area and the Authority would work closely with the city to review a proposed maintenance facilty and seek a site that is complementary to the City's vision.

4.2 Evaluation Measures

No modifications or updates to this section.

4.2.1 Capital Cost

No modifications or updates to this section.

4.2.2 Property Impact

No modifications or updates to this section.

4.2.3 Utilities

No modifications or updates to this section.

4.2.4 Environmental Resources and Measures

No modifications or updates to this section.

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4.3 Summary of Evaluation Results

For clarity, the following paragraphs are reprinted from the Preliminary Alternatives Analysis Report:

On the following pages, the study corridor is described from north to south by subsection. When a new subsection is introduced, the first set of facing pages provides an overview of the subsection and the evaluation highlights for that subsection. The top of the left hand page includes a brief description of the subsection, followed by an aerial photograph showing the horizontal placement of the study corridor. Below the aerial is a schematic diagram of the vertical design options considered in the evaluation. The subsection boundaries are shown graphically below the schematic diagram.

At the top of the right hand page, the sub-subsections are listed with the applicable vertical design options that were carried forward into the detailed evaluation. Following this listing, some pages include notes on the feasibility of specific vertical profiles. These notes are derived from the engineering analysis of the plan and profile, as shown in Appendix B. The location corresponding to each note is shown on the schematic diagram on the left hand page. Following the feasibility notes (if present) is a listing and description of the options carried forward into preliminary engineering design and environmental review as part of the EIR/EIS. This is followed by a listing of the options that will not be carried forward, including the primary reasons for this recommendation.

Station alternatives are discussed in the subsection where they are located. The following stations and location alternatives are being carried forward for further engineering and environmental analysis in these respective subsections:

- Downtown San Francisco – Subsection 0A
- Millbrae (SFO) – Subsection 3D
- Potential Mid-Peninsula Station Locations:
  - Redwood City – Subsection 4C
  - Palo Alto – Subsection 6A
  - Mountain View – Subsection 7B
- San Jose Diridon – Subsection 9B

Following the introductory set of facing pages are a series of tables noting the presence, absence, extent, or amount of each impact, resource, hazard, sensitive receptor, or land use. In these tables, the vertical options identified to be carried forward for further engineering and environmental analysis are indicated with a white background in the table heading. Those options which were not carried forward are indicated with a black background in the table heading. In addition, for those options not carried forward, the primary reason(s) for this recommendation is indicated by shading in the table.

4.3.1 Subsection 0 – San Francisco

No modifications or updates to this section.

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Subsection #1

Length: 4.8 miles Land Use: Urban

North of Common Street to South Portal Tunnel No. 4 (MP. 1.03 to MP. 5.77)
This subsection is located within the City and County of San Francisco. Except for two crossings near Mission Bay, all other street crossings in this subsection are grade separated. The existing Caltrain alignment passes through a series of hills and valleys necessitating 4 tunnels and several embankment and trench segments. The I-280 freeway structure above the tracks and its supporting columns are constraints in the northern portion of the subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

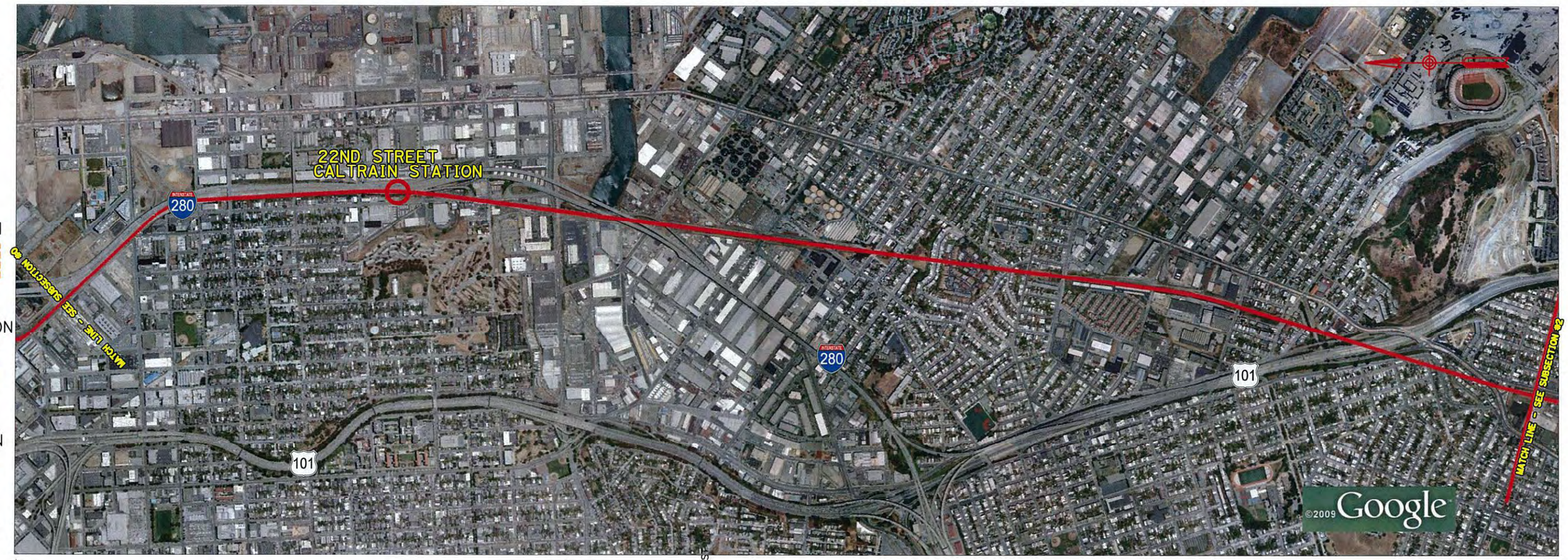
CALTRAIN STATION DESIGN OPTION

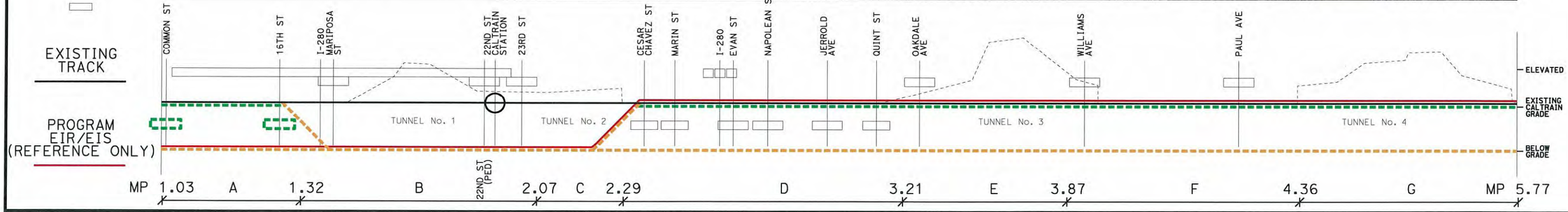
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.2 Subsection 1 – San Francisco

This section has been modified to read as follows:

Options Considered

- Subsection 1A – North of Mission Bay Drive to South of 16th Street
    - At Grade
    - Covered Trench/Tunnel
- Subsection 1B – South of 16th Street to South of 23rd Street
    - At Grade
    - Covered Trench/Tunnel
- Subsection 1C – South of 23rd Street to North of Cesar Chavez Street
    - At Grade
    - Covered Trench/Tunnel
- Subsection 1D – North of Cesar Chavez Street to South of Quint Street
    - At Grade
    - Covered Trench/Tunnel
- Subsection 1E – South of Quint Street to North of Williams Street
    - At Grade
    - Covered Trench/Tunnel
- Subsection 1F – North of Williams Street to South of Paul Avenue
    - At Grade
    - Covered Trench/Tunnel
- Subsection 1G – South of Paul Avenue to South of Portal Tunnel No. 4
    - At Grade
    - Covered Trench/Tunnel

Options Carried Forward

In this area of hilly terrain, a combined At Grade and Covered Trench/Tunnel option is recommended to be carried forward into further engineering and environmental analysis. This option includes a new 2-track tunnel parallel to existing 2-track Caltrain tunnels 1-4 made necessary by the hills and steep terrain along this alignment. Caltrain and freight would continue to use the existing Caltrain tracks. The new 2-track Covered Trench/Tunnel would begin as a shallow tunnel under 7th Street and continue as a deeper tunnel under Pennsylvania Avenue. Substantial right-of-way acquisition would be required along 7th Street if a 4-track At Grade option was selected in this segment. The existing railroad leads to the Port of San Francisco and Hunters Point would continue to be served by the existing Caltrain tracks.

Options Not Carried Forward

None.

Table 4-1
Summary Comparison of Design Options for Subsection 1 – San Francisco

No modifications or updates to this Table.

Subsection #2

Length: 8.6 miles Land Use: Urban

South Portal Tunnel No. 4 to South of Millbrae Avenue (MP. 5.77 to MP. 14.38)
This subsection is located in the Cities of Brisbane, South San Francisco, San Bruno and Millbrae. The existing Caltrain alignment is at-grade in this subsection and many crossings are grade separated. The northern portion of this subsection is completely grade separated and includes an existing 4-track segment in Brisbane. In the southern portion of the subsection, BART runs underneath and alongside the Caltrain tracks.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

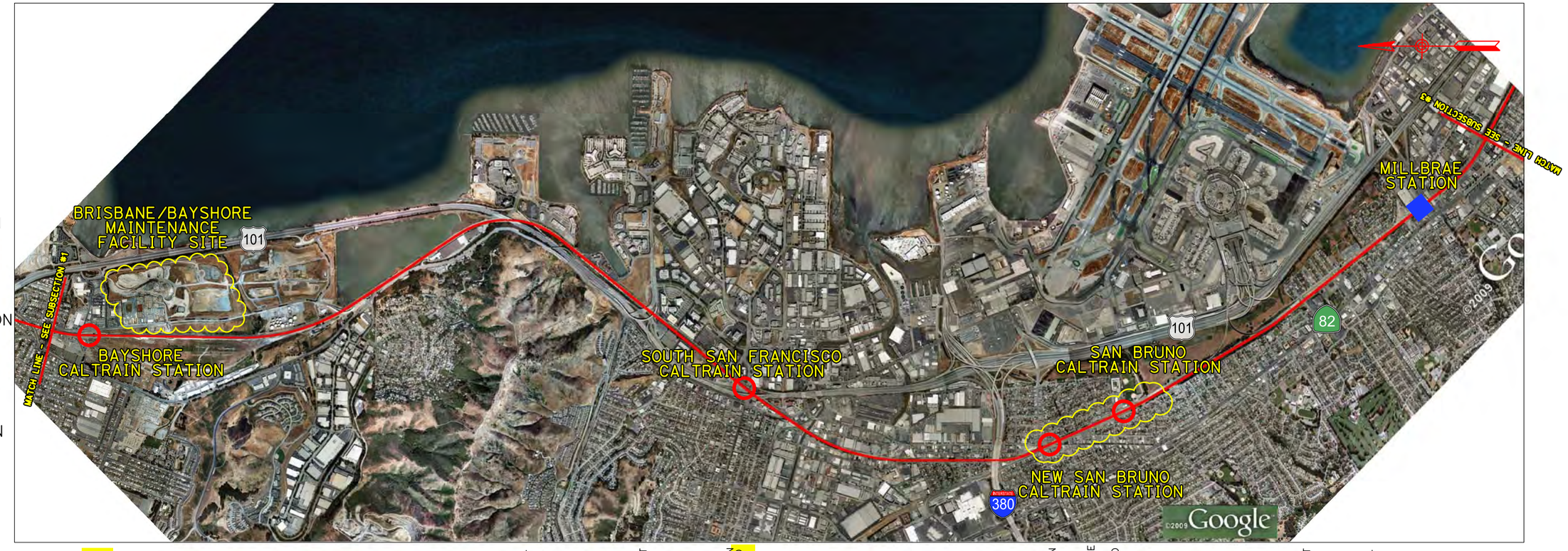
CALTRAIN STATION DESIGN OPTION

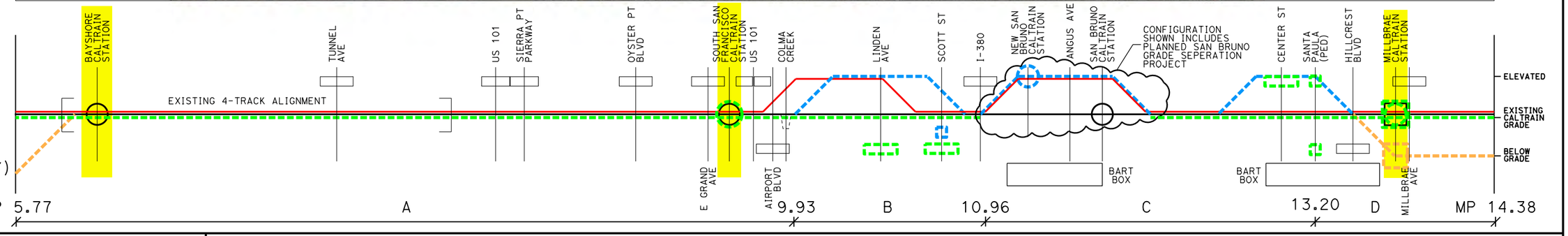
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.3 Subsection 2 – Brisbane, South San Francisco, San Bruno and Millbrae

This section has been modified to read as follows:

Options Considered

- Subsection 2A – South Portal Tunnel No. 4 to South of Colma Creek
  - At Grade
- Subsection 2B – South of Colma Creek to South of I-380
  - Aerial Viaduct
  - Berm
  - At Grade
- Subsection 2C(1) – South of I-380 to South of Angus Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench (HST Only)
  - Covered Trench/Tunnel (HST Only)
- Subsection 2C(2) – South of Angus Avenue to South of Center Street
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench (HST Only)
  - Covered Trench/Tunnel (HST Only)
- Subsection 2D – South of Center Street to South of Millbrae Avenue
  - At Grade
  - Open Trench (HST Only)
  - Covered Trench/Tunnel (HST Only)

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 2A: At Grade. The existing tracks are at grade and all roadway crossings are grade separated. This subsection also includes an existing four-track segment. . The Maintenance Facility in the Bayshore area of Brisbane would be located in this subsection.
- 2B: Berm. The tracks would be partially elevated and roadway crossings would be partially depressed.
- 2C(1): Berm. The San Bruno Grade Separation Project is located in this subsection; the Alternatives Analysis assumes that this project will be constructed.
- 2C(2): Berm and Open Trench. This would be a configuration where 2 tracks begin to transition to a Berm for a new grade separation at Center Street. At the same time, 2 tracks would begin to transition to an Open Trench for the lower-level portion of the Millbrae (SFO) HST station.
- 2D: At Grade and Covered Trench/Tunnel. This would be a configuration that leaves the existing Caltrain tracks in the At Grade option and stacks 2 new tracks and the Millbrae (SFO) HST station below the existing tracks in the Covered Trench/Tunnel option. This configuration would avoid right-of-way impacts at the Millbrae intermodal station where there are local plans for a transit-oriented development. For a short segment, a cover would be placed on the trench to allow vehicular and pedestrian circulation to occur adjacent to the Millbrae intermodal station. The new tracks would need to be below the existing storm drains crossing the Caltrain corridor south of Hillcrest Boulevard. An alternate configuration still under consideration would place one HST track and platform below grade, and 3 tracks, the Caltrain platforms and the other HST platform at grade.

Options Not Carried Forward

The following options are not to be carried forward for the reasons listed below:

- 2A: None.
- 2B: Aerial Viaduct, At Grade. A fully elevated Aerial Viaduct option is not practical due to the impacts on freight rail connections to South San Francisco Yard and the Granite Rock/Central Concrete tracks. An At Grade option would have substantial property impacts due to right-of-way needed for grade separations at Linden Avenue and Scott Street.
- 2C(1): Aerial Viaduct, At Grade, Open Trench, Covered Trench. These options are not compatible with the San Bruno Grade Separation Project and would require significant re-work to the San Bruno project's design concept, potentially jeopardizing its current funding.
- 2C(2) Aerial Viaduct, At Grade, Covered Trench. These options are not compatible with the configuration carried forward in Subsection 2D.
- 2D: Open Trench. This configuration would have right-of-way impacts at the Millbrae intermodal station where there are local plans for a transit-oriented development.

Table 4-2
Summary Comparison of Design Options for Subsection 2 – Brisbane, South San Francisco, San Bruno, Millbrae

Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options				
		Route length	Same for all options	Same for all options	Same for all options	Same for all options	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Aerial Viaduct option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	74 million	-	66 million	-	144 million	156 million	77 million	197 million	368 million
		Acquisition cost of additional ROW	Highest	Medium	Medium	Highest	Medium	Medium	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable			Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies			Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 103'. Approximately 15% of subsection is <90' and 85% over 100'	Medium; Nominal width with TCE for this option is 109'. Approximately 15% of subsection is <90' and 85% over 100'	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 103'. Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE	Low; Nominal width with TCE for this option is 109'. Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE	Construction would primarily occur within ultimate ROW	Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE	Approximately 70% of subsection is <90' and 30% over 100'. Public ROW available for TCE

Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Sierra Point Lumber Spur and South San Francisco Yard	Not feasible to maintain connections to South San Francisco Yard and Granite Rock/Central Concrete Trackage	South San Francisco Yard and Granite Rock/Central Concrete Trackage	South San Francisco Yard and Granite Rock/Central Concrete Trackage	Not compatible with San Bruno Grade Separation Project		Not compatible with San Bruno Grade Separation Project		
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None			None				
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW of <90'' and 90% is over 100'	Low; Nominal width for this option is 79'. Existing ROW is over 80' throughout the subsection	Low; Nominal width for this option is 85'. Approximately 15% of subsection has existing ROW between 80'-89' and 85% is over 100'	Medium; Nominal width for this option is 96'. Approximately 15% of subsection has existing ROW <90' and 85% is over 100', impacts due to grade separations at Linden Avenue and Scott Street	Low; Nominal width for this option is 79'. Approximately 10% of subsection has existing ROW <70', 25% is between 70'-79', 65% is over 80'	Low; Nominal width for this option is 85'. Approximately 35% of subsection has existing ROW <80', 35% is between 80'-89' and 30% is over 100'	Medium; Nominal width for this option is 96'. Approximately 70% of subsection has existing ROW <90' and 30% is over 100', impacts due to grade separation at Center Street	Approximately 35% of subsection has existing ROW <80', 35% is between 80'-89' and 30% is over 100'	Approximately 35% of subsection has existing ROW <80', 35% is between 80'-89' and 30% is over 100'
	Properties with access affected	Properties with access affected	None	None	None	Access for properties affected due to grade separations at Linden Avenue and Scott Street	None	None	Access for properties affected due to grade separation at Center Street	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable			Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None	Improved traffic conditions with grade separations at Linden Avenue and Scott Street	Improved traffic conditions with grade separations at Linden Avenue and Scott Street	Improved traffic conditions with grade separations at Linden Avenue and Scott Street	Improved traffic conditions with grade separation at Center Street				
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	3.89 acres	Similar or lower impact than At Grade option	Similar or lower impact than At Grade option	0.05	Similar or lower impact than At Grade option	Similar or lower impact than At Grade option	0.38	0.38; greater impacts than At Grade option	
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead,	None	None			None				

Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench / Tunnel (HST Only)
		identified as Present or None)									
	Cultural resources	Number of historic structures within ultimate ROW	3	2	2	2	None				
		Archeological Sensitivity (identified as present or not)	Present	Present			Present		Present; lower impacts than Aerial Viaduct and Berm options	Present	
	Parklands	Acres of parklands within ultimate ROW	None	None			None				
	Agricultural lands	Acres of farmland	Not applicable	Not applicable			Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R-41-60, I<5, M<5, P=11-20	R=101-200, P=5-10	R=101-200, P=5-10	Lower impacts than Aerial Viaduct and Berm options	R=501-700, I=5-10, M<5, S=5-10, P=5-10	R=501-700, I=5-10, M<5, S=5-10, P=5-10	Lower impacts than Aerial Viaduct and Berm options		
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=11-20, I<5, M<5, P=20-40	Lower impacts than At Grade option		R=61-100, P<5	Lower impacts than At Grade option		R=301-500, I=5-10, M<5, S=5-10, P=5-10	Lower impacts than Aerial Viaduct and Berm options	
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=5-10	R=21-40, P<5	R=21-40, P<5	Lower impacts than Aerial Viaduct and Berm options	R=201-300, P<5	R=201-300, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	
		Number of scenic roadways that cross the ROW	None	Minimal impacts		2	Minimal impacts		2	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	60%	32%	32%	32%	9%	9%	9%	9%	9%

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Evaluation Measure			2A - South Portal Tunnel No. 4 to South of Colma Creek	2B - South of Colma Creek to South of I-380			2C - South of I-380 to South of Center Street				
			At Grade	Aerial Viaduct	Berm	At Grade	Aerial Viaduct	Berm	At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	2/18	2/5	2/5	2/5	0/8	0/8	0/8	0/8; greater impacts than At Grade option	
Alternative Carried Forward into EIR/EIS			Yes	No	Yes	No	No	Yes	No	No	No

Subsection 2 continued

Evaluation Measure			2D - South of Center Street to South of Millbrae Avenue		
			At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options		
		Route length	Same for all options		
	Maximize connectivity and accessibility	Intermodal connections	Same for all options		
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	14 million	159 million	314 million
		Acquisition cost of additional ROW	Highest	Medium	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options (Millbrae HST Station in this subsection)		
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Inconsistent with adopted plans and policies	Consistent with adopted plans and policies

Evaluation Measure			2D - South of Center Street to South of Millbrae Avenue		
			At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 80% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 120'. Approximately 80% of subsection has existing ROW over 100'
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None		
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	11' wide and 60' wide storm drains south of Hillcrest Boulevard	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Approximately 20% of subsection has existing ROW <90' and 80% is over 100'	Low; Approximately 20% of subsection has existing ROW <90' and 80% is over 100'	Low; Approximately 20% of subsection has existing ROW <90' and 80% is over 100', Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None		
	Local traffic effects around station	Increase in traffic congestion	Same for all options		
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None		
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impact than Trench options	0.48	0.48
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None		
	Cultural resources	Number of historic structures within ultimate ROW	1	1	1
		Archeological Sensitivity (identified as present or not)	Present; Lower impacts than Trench options	Present	
	Parklands	Acres of parklands within ultimate ROW	None		
	Agricultural lands	Acres of farmland	Not applicable		

Evaluation Measure			2D - South of Center Street to South of Millbrae Avenue		
			At Grade	Open Trench (HST Only)	Covered Trench/Tunnel (HST Only)
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=61-100, I<5, M=5-10P<5	Lower impacts than At Grade option	Lower impacts than Open Trench option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=41-60, I<5, MP<5	Lower impacts than At Grade option	
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=20-40	Minimal impacts	
		Number of scenic roadways that cross the ROW	1	Lower impacts than At Grade option	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Trench options	0/5	0/5
Alternative Carried Forward into EIR/EIS			Yes	No	Yes

Subsection #3

Length: 4.9 miles Land Use: Urban

South of Millbrae Avenue to North of Highway 92 (MP. 14.38 to MP. 19.29)
This subsection is located in the Cities of Burlingame and San Mateo. In this subsection, the Caltrain tracks are primarily at-grade as are most of the crossings; those that are grade-separated have sub-standard clearances. This subsection includes a tight area through downtown San Mateo where a number of closely spaced at-grade crossings are an integral part of the street grid.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

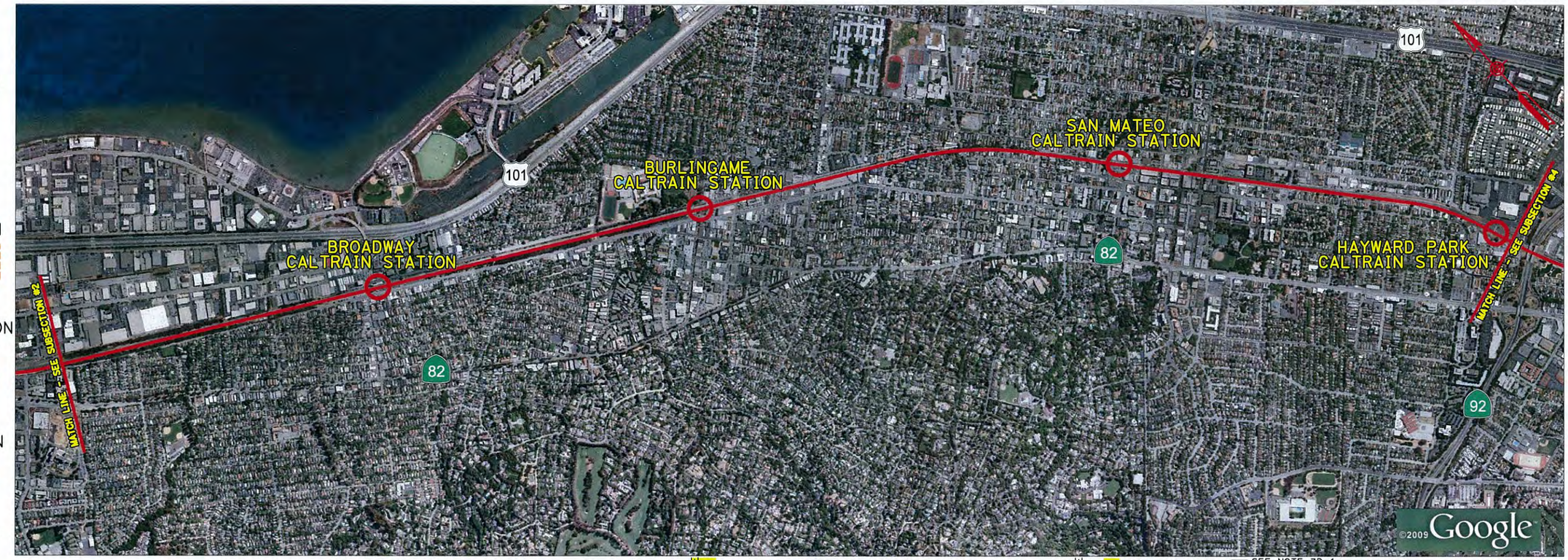
CALTRAIN STATION DESIGN OPTION

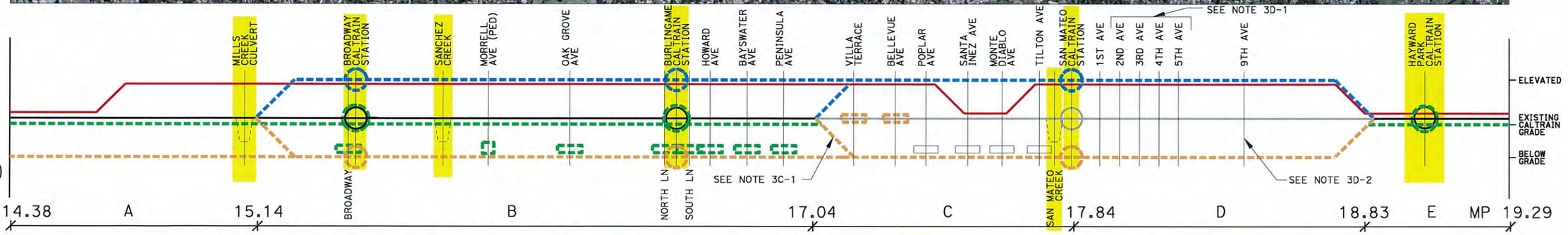
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

4.3.4 Subsection 3 – Burlingame and San Mateo

This section has been modified to read as follows:

Options Considered

- Subsection 3A – South of Millbrae Avenue to South of Mills Creek
  - Aerial Viaduct
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid
- Subsection 3B – South of Mills Creek to North of Villa Terrace
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid
- Subsection 3C – North of Villa Terrace to North of San Mateo Caltrain Station
  - Aerial Viaduct
  - Berm
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid
- Subsection 3D – North of San Mateo Caltrain Station to North of Hayward Park Station
  - Aerial Viaduct
  - Berm
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid
- Subsection 3E – North of Hayward Park Station to North of Highway 92
  - At Grade

Vertical Profile Feasibility Notes

Note	Issue	Description
3C-1	Adjusted	Unable to begin elevated and below grade options after Peninsula Avenue due to clearance constraints at Bellevue Avenue. Peninsula Avenue and Villa Terrace would need to be adjusted vertically.
3D-1	Adjusted	2nd Avenue, 3rd Avenue, 4th Avenue and 5th Avenue would need to be partially lowered for elevated option due to constraint of returning to grade prior to horizontal curves.
3D-2	Adjusted	9th Avenue would need to be adjusted vertically for elevated and below grade options due to constraints of returning to grade prior to horizontal curves.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 3A: At Grade, Open Trench.
- 3B-3D: Aerial Viaduct, Open Trench. The Open Trench option would need to be below the existing storm drains crossing the Caltrain corridor near Oak Grove Avenue and Villa Terrace.
- 3E: At Grade.

Options Not Carried Forward

The following options are not to be carried forward for the reasons listed below:

- 3A: Aerial Viaduct, Covered Trench/Tunnel, Hybrid. The Aerial Viaduct option is not compatible with the options carried forward in Subsection 2D.

  The Covered Trench/Tunnel option is impracticable due to major constructability issues, surface disruption to surface land uses, additional right-of-way requirements, much greater construction risk, high cost factors, and lengthy construction schedules and construction impacts. The Covered Trench/Tunnel option also has a greater ROW requirement for construction than the Open Trench option and requires significant ventilation and life safety features.

  The Hybrid option requires significant additional ROW for transitions from the 4-track side-by-side configuration. In order to change from a four-track parallel configuration to the four-track stacked configuration, a 5000-foot long transition segment is required. In this transition segment, the “weaving” structures needed to move two tracks from a side-by-side to a stacked configuration require right-of-way approximately 120-135 feet wide. For each stacked segment, two of these 5000-foot long transition segments are required, one to the north and one to the south of the stacked area. Combined, these two transition segments would create about 2 miles of alignment that would most likely have adverse affects on permanent right of way needs.

The Hybrid option does not enhance the interoperability between HST and Caltrain. Operational flexibility on the corridor would be limited in the stacked areas. Trains would be limited to either the Caltrain or HST tracks for the length of the configuration (ranging from 3-6 miles) with no opportunity for connection. Construction also would be difficult for the Hybrid alternative. It would require a 70-80 foot deep trench to be built for HST at the lower level and then an intermediate floor would need to be built to support the Caltrain and freight trains at the upper level. This would be difficult and very expensive to build.

- 3B-3D: At Grade, Berm, Covered Trench/Tunnel, Hybrid. The At Grade option would require substantial right-of-way acquisition due to existing at grade roadway crossings. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or open trench option. The Covered Trench/Tunnel option has a greater ROW requirement for construction than the Open Trench option and requires significant ventilation and life safety features. The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration.
- 3E: None.

Table 4-3
Summary Comparison of Design Options for Subsection 3 – Burlingame, San Mateo

Evaluation Measure			3A - South of Millbrae Avenue to South of Mills Creek				
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				
		Route length	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than At Grade option due to aerial structure	Lowest	Higher than Aerial Viaduct and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Aerial Viaduct and Open Trench options, due to structures, walls, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	-	12 million	139 million	356 million	449 million
		Acquisition cost of additional ROW	-	Lowest	Lowest	Medium	Medium (affects other subsection)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Inconsistent with adopted plans and policies (affects other subsection)	Consistent with adopted plans and policies			Consistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 102'. Existing ROW is over 100' throughout the subsection	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Existing ROW is over 100' throughout the subsection	Low; Nominal width with TCE for this option is 120'. Existing ROW is over 100' throughout the subsection	Low; Nominal width with TCE for this option is 120'. Existing ROW is over 100' throughout this subsection
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None				
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	2-83"x53" Oval CIP storm drain		2-83"x53" Oval CIP storm drain

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Evaluation Measure			3A - South of Millbrae Avenue to South of Mills Creek				
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW is over 100' throughout the subsection	Low; Nominal width for this option is 96'. Existing ROW is over 100' throughout the subsection	Low; Nominal width for this option is 96'. Existing ROW over 100' throughout the subsection	Low; Nominal width for this option is 96'. Existing ROW over 100' throughout the subsection, Possibly some due to ventilation structures	Low; Nominal width for this option is 70'. Existing ROW over 100' throughout the subsection, Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None				
	Local traffic effects around station	Increase in traffic congestion	Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None				
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impact than Trench options		0.46	0.46	0.46
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None				
	Cultural resources	Number of historic structures within ultimate ROW	None				
		Archeological Sensitivity (identified as present or not)	None				
	Parklands	Acres of parklands within ultimate ROW	None				
	Agricultural lands	Acres of farmland	Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=41-60	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than At Grade option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=21-40; lower impacts than At Grade option	R=21-40	Lower impacts than At Grade option		
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=11-20	R=11-20; lower impacts than Aerial Viaduct option	Minimal impacts		

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Evaluation Measure			3A - South of Millbrae Avenue to South of Mills Creek				
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
		Number of scenic roadways that cross the ROW	None				
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	66%	66%	Minimal impacts		
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None				
Alternative Carried Forward into EIR/EIS			No	Yes	Yes	No	No

Subsection 3 continued

Evaluation Measure			3B - South of Mills Creek to North of Villa Terrace					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					
		Route length	Same for all options					
	Maximize connectivity and accessibility	Intermodal connections	Not applicable					
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to structures, walls, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	245 million	-	-	413 million	937 million	1,171 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Lowest	Medium	Medium (affects other subsection)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable					
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies

US Department of Transportation
Federal Railroad Administration

Evaluation Measure			3B - South of Mills Creek to North of Villa Terrace					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
				create a perceived barrier through this area which is not consistent with the local communities' character and land uses				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 70% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 109'. Approximately 70% of subsection has existing ROW over 100'	Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 70% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 120'. Approximately 70% of subsection has existing ROW over 100'	Low; Nominal width with TCE for this option is 120'. Approximately 70% of subsection has existing ROW over 100'
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None					
	Disruption / relocation of utilities	Identify major utilities requiring relocation	60kV electric junction line near 9th Avenue	60kV electric junction line near 9th Avenue	None	2-90" RCP near Oak Grove Avenue		2-90" RCP near Oak Grove Avenue
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Approximately 20% of subsection has existing ROW between 70'-79' and 80% is over 80'	Low; Nominal width for this option is 85'. Approximately 20% of subsection has existing ROW <80', and 80% is over 90'	High; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90', 10% is between 90'-99' and 70% is over 100', impacts due to grade separations at Broadway, Oak Grove Avenue, North Lane, South Lane, Howard Avenue, Bayswater Avenue and Peninsula Avenue	Low; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90', 10% is between 90'-99' and 70% is over 100'	Low; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90'', 10% is between 90'-99' and 70% is over 100', Possibly some due to ventilation structures	Low; Nominal width for this option is 96'. Approximately 20% of subsection has existing ROW <90'', 10% is between 90'-99' and 70% is over 100', Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to grade separations at Broadway, Oak Grove Avenue, North Lane, South Lane, Howard Avenue, Bayswater Avenue and Peninsula Avenue	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable					
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Improved traffic conditions with grade separations at Broadway, Oak Grove Avenue, North Lane, South Lane, Howard Avenue, Bayswater Avenue and Peninsula Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	1.0 acres	1.0 acres	1.0 acres

Evaluation Measure			3B - South of Mills Creek to North of Villa Terrace					
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Hybrid**
	areas affected	Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None					
	Cultural resources	Number of historic structures within ultimate ROW	1	1	1	1	1	1
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present	Present
	Parklands	Acres of parklands within ultimate ROW	None					
	Agricultural lands	Acres of farmland	Not applicable					
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I<5, M<5, P<5	R=301-500, I=5-10, M<5, S<5, P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than At Grade option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, I<5, S<5, P=5-10	Lower impacts than Berm option	Lower impacts than Berm option	Lower impacts than Berm option
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200	R=101-200, P<5; Strong community perception of significant "barrier effect" from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	15%	15%	15%	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options, depending on siting of support columns	Lower impacts than Trench options	Lower impacts than Trench options	0/8	0/8	0/8
Alternative Carried Forward into EIR/EIS			Yes	No	No	Yes	No	No

Subsection 3 continued

Evaluation Measure			3C & 3D - North of Villa Terrace to North of Hayward Park Station					3E - North of Hayward Park Station to North of Highway 92
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Hybrid	At Grade
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					Same for all options
		Route length	Same for all options					Same for all options
	Maximize connectivity and accessibility	Intermodal connections	Not applicable					Not applicable
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm option, due to aerial structure	Lowest	Higher than Berm option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Low
		Capital cost ($ 2009), does not include ROW	238 million	-	405 million	894 million	1,116 million	30 million
		Acquisition cost of additional ROW	Medium	Medium	Lowest	Medium	Medium (affects other subsection)	Highest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable					Not applicable
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Inconsistent with adopted plans and policies			Consistent with adopted plans and policies
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	High; Nominal width with TCE for this option is 103'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 109'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	High; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	Low; Construction would primarily occur within ultimate ROW
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None					None
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None		10' wide storm drain near Villa Terrace			None

Evaluation Measure			3C & 3D - North of Villa Terrace to North of Hayward Park Station					3E - North of Hayward Park Station to North of Highway 92
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Hybrid	At Grade
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Medium; Nominal width for this option is 79'. Approximately 15% of subsection has existing ROW <70', 20% is between 70'-79' and 65% is over 80'	Medium; Nominal width for this option is 85'. Approximately 35% of subsection has existing ROW <80', 15% is between 80'-89' and 50% is over 90'	Medium; Nominal width for this option is 96'. Approximately 50% of subsection has existing ROW <90', 15% between 90'-99' and 35% over 100'	Medium; Nominal width for this option is 96'. Approximately 50% of subsection has existing ROW <90', 15% is between 90'-99' and 35% is over 100', Possible impacts due to ventilation structures	Medium; Nominal width for this option is 70'. Approximately 50% of subsection has existing ROW <90', 15% is between 90'-99' and 35% is over 100', Possible impacts due to ventilation structures	Low; Nominal width for this option is 96'. Existing ROW is over 100' throughout this subsection
	Properties with access affected	Properties with access affected	Access for properties affected due to ultimate ROW requirements					None
	Local traffic effects around station	Increase in traffic congestion	Not applicable					Not applicable
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 traffic lane along Railroad Avenue; Improved traffic conditions at grade separations in this subsection	Loss of 1 traffic lane along Railroad Avenue; Improved traffic conditions at grade separations in this subsection; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Loss of 1 traffic lane along Railroad Avenue; Improved traffic conditions at grade separations in this subsection			None
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm options	Lower impacts than Trench options	0.06 acres	0.06 acres	0.06 acres	0.14 acres
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None					None
	Cultural resources	Number of historic structures within ultimate ROW	4	4	4	4	4	None
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present	Present	Present
	Parklands	Acres of parklands within ultimate ROW	None					None
	Agricultural lands	Acres of farmland	Not applicable					Not applicable
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=701-1000, I<5, M<5; S<5	R=701-1000, I<5, M<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Open Trench option	Lower impacts than Open Trench option	R=101-200, I<5

Evaluation Measure			3C & 3D - North of Villa Terrace to North of Hayward Park Station					3E - North of Hayward Park Station to North of Highway 92
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Hybrid	At Grade
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=501-700; I<5; M<5	R=501-700	Lower impacts than Berm and Aerial Viaduct options	Lower impacts than Berm and Aerial Viaduct options	Lower impacts than Berm and Aerial Viaduct options	R=61-100, P<5
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=200-500	R=501-700; Strong community perception of significant "barrier effect" from berm structure though this area	Minimal impacts			R=20-40
		Number of scenic roadways that cross the ROW	2	2	Minimal impacts			3
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	3%	3%	Minimal impacts			1%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Trench options, depending on siting of support columns	Lower impacts than Trench options	3/12	3/12	3/12	0/8
Alternative Carried Forward into EIR/EIS			Yes	No	Yes	No	No	Yes

Subsection #4

Length: 7.6 miles Land Use: Urban

North of Highway 92 to North of 5th Avenue (MP. 19.29 to MP. 26.88)
This subsection is located in the Cities of San Mateo, Belmont, San Carlos and Redwood City. For most of the northern portion of this subsection, the existing Caltrain tracks are on a recently constructed embankment that passes over the cross streets. In the southern portion of this subsection the at-grade Caltrain tracks pass through a number of at-grade crossings in downtown Redwood City. There is an existing 4 track segment at the southern end of this subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

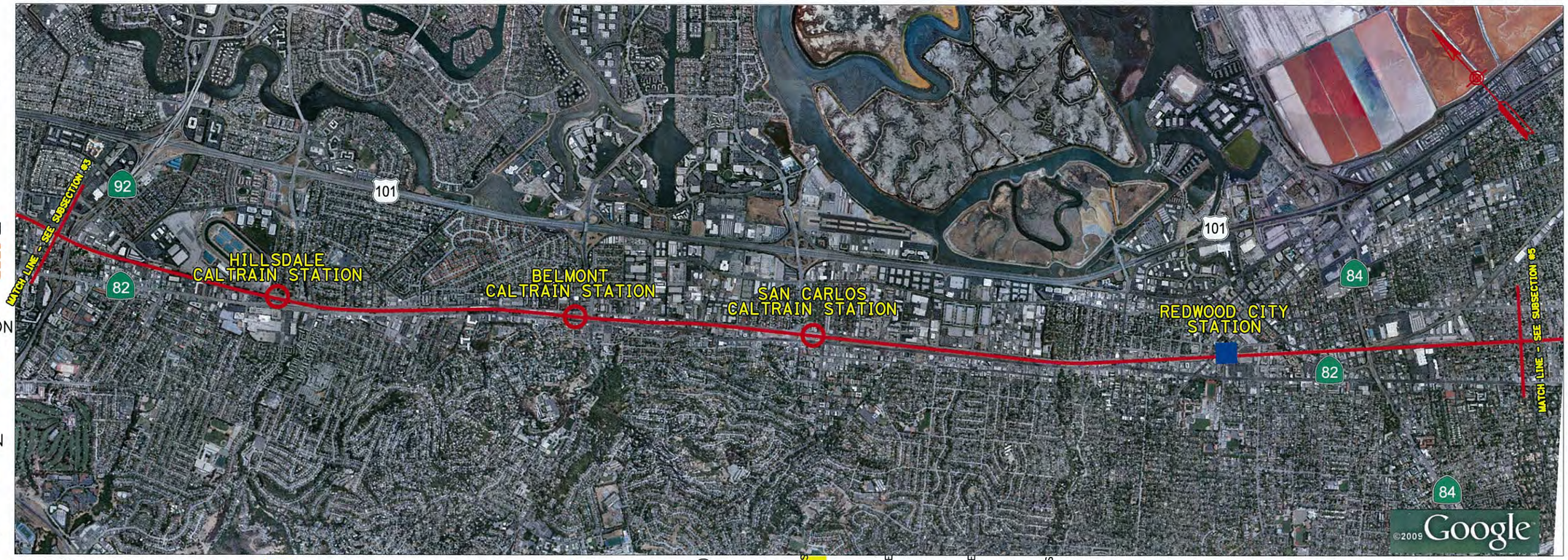
CALTRAIN STATION DESIGN OPTION

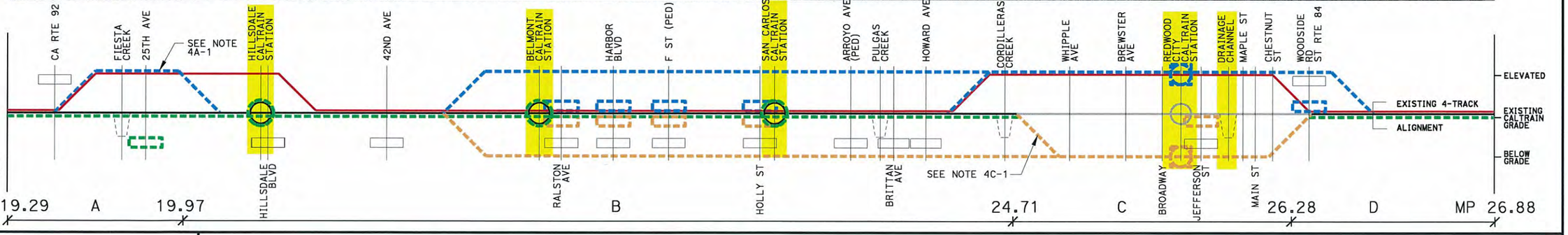
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.5 Subsection 4 – San Mateo, Belmont, San Carlos and Redwood City

This section has been modified to read as follows:

Options Considered

- Subsection 4A – North of Highway 92 to South of 25th Avenue
  - At Grade
  - Berm
- Subsection 4B(1) – South of 25th Avenue to South of 42nd Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 4B(2) – South of 42nd Avenue to South of Cordilleras Creek
  - Aerial Viaduct
  - Berm
  - At Grade
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 4C – South of Cordilleras Creek to North of Woodside Road
  - Aerial Viaduct
  - Berm
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 4D – North of Woodside Road to North of 5th Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)

Vertical Profile Feasibility Notes

Note	Issue	Description
4A-1	Adjusted	25th Avenue would need to be partially lowered for the elevated option due to vertical curve constraints caused by horizontal curves.
4C-1	Adjusted	Unable to begin below grade transition after Cordilleras Creek due to clearance constraints at Whipple Avenue and transition is relocated to vicinity of Holly Street.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 4A: Berm. This would be a configuration where the tracks are partially elevated and 25th Avenue is partially depressed.
- 4B(1): Berm. The Berm option would accommodate local plans for a transit-oriented development that call for 28th Avenue and 31st Avenue to extend across the Caltrain corridor. The transit-oriented development plan also includes the potential relocation of the Hillsdale Caltrain station approximately ¼ mile north of its present location.
- 4B(2): Aerial Viaduct. The alignment begins to transition to the grade separation at Ralston Avenue.
- 4C: Aerial Viaduct. This subsection includes the Redwood City Caltrain station, which is a location option for the potential Mid-Peninsula HST station.
- 4D: At Grade. The At Grade option allows for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur

Options Not Carried Forward

The following options are not to be carried forward for the reasons listed below:

- 4A: The At Grade option is not practical due to the short transition distance between 25th Avenue and 28th Avenue.
- 4B(1): The Aerial Viaduct, At Grade, Covered Trench/Tunnel and Deep Tunnel options are not compatible with local transit-oriented development plans and the configuration carried forward in Subsection 4B(2).
- 4B(2)-4C: The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). In addition, the trench options would have high construction costs due to the deep trench required to pass under Pulgas and Cordilleras creeks. Construction of the trench options would require building a temporary shoofly for Caltrain outside the existing right-of way because the existing tracks are in the center of the right-of-way, and because the trench would need to be set back 15 to 25 feet from the zone of influence of the existing Caltrain embankment structure. The shoofly most likely would be a temporary aerial structure since the existing road crossings are already grade-separated.

  The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost. The high construction risks

and costs are a result of factors such as potential settlement and its associated cost for repairs and damages, performing soil improvements from the surface for the excavation of tunnels and caverns, construction schedule delays and possible contractor claims, and settlement potential of nearby foundations. The Deep Tunnel option also has surface impacts associated with ventilation, stairs, elevator shafts, and emergency access shafts, which potentially would result in residential or business impacts or displacements due to the need to locate these shafts at the surface. The actual number would need to be determined during more detailed design. In addition, all tunnel alternatives would have higher operating costs (ventilation, pumps, lighting, stairs and elevators, etc.), costlier fire prevention, and greater time required for emergency response (in case of a fire).

During construction, the Deep Tunnel option would require utility relocations, dewatering, and muck removal at all portal locations, access points and where needed for safety. Additional areas would be needed for assembly of Tunnel Boring Machine's (TBM) "trailing gear." There would also be vibration impacts from construction, operations and fans providing construction ventilation.

- 4D: The Aerial Viaduct, Berm, Open Trench, Covered Trench/Tunnel, and Deep Tunnel options do not allow for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur. The Open Trench option would require converting approximately 3,000 feet of the Dumbarton branch to a trench to accommodate a transition from the Caltrain corridor. The Port of Redwood City spur would have to be converted to a trench (open, partially covered, or completely covered) for approximately 6,000 feet (to the east side of US 101) to accommodate a transition from the Caltrain corridor. This additional construction requires additional right-of-way which potentially would result in residential or business impacts or displacements.

Table 4-4
Summary Comparison of Design Options for Subsection 4 – San Mateo, Belmont, San Carlos, Redwood City

Evaluation Measure			4A - North of Highway 92 to South of 25th Avenue		4B - South of 25th Avenue to South of Cordilleras Creek				
			At Grade	Berm	Aerial Viaduct	Berm	At Grade	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options	Same for all options	Same for all options				
		Route length	Same for all options	Same for all options	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable	Not applicable	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Low	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than other options, due to ventilation, life safety, etc	Higher than other options, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	-	50 million	541 million	--	248 million	1,760 million	1,502 million
		Acquisition cost of additional ROW	Highest	Medium	Medium	Medium	Highest	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable	Not applicable	Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies	Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW; distance from Highway 92 to 25th Avenue is too short to make transition to aerial	Medium; Nominal width with TCE for this option is 107'. Approximately 70% of subsection has existing ROW less than 100'	Medium; Nominal width with TCE for this option is 102'. Approximately 55% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 107'. Approximately 55% of existing ROW less than 100'	Low; Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 116'. Approximately 55% of existing ROW less than 100'	Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations

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Evaluation Measure			4A - North of Highway 92 to South of 25th Avenue		4B - South of 25th Avenue to South of Cordilleras Creek				
			At Grade	Berm	Aerial Viaduct	Berm	At Grade	Covered Trench/Tunnel	Deep Tunnel (HST Only)
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None	None	None				
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	None			60" Storm drain pipe near Harbor Boulevard	None
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Approximately 70% of subsection has existing ROW <80' and 30% over 100', impacts due to grade separation at 25th Avenue	Low; Nominal width for this option is 85'. Approximately 70% of subsection has existing ROW <80' and 30% over 100', impacts	Low; Nominal width for this option is 79'. Approximately 20% of subsection has existing ROW <70', 10% between 70'-79', and 70% over 80'	Low; Nominal width for this option is 85'. Approximately 30% of subsection has existing ROW <80', 10% between 80'-89' and 60% over 90'	Medium; Nominal width for this option is 96'. Approximately 40% of subsection has existing ROW <90', 20% between 90'-99' and 40% over 100', impacts due to grade adjustments at Ralston Avenue, Harbor Boulevard and Holly Street	Low; Nominal width for this option is 96'. Approximately 40% of subsection has existing ROW <90', 20% between 90'-99' and 40% over 100'	Low; Possibly some impacts due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	None	None	Access affected for properties due to grade adjustments at Ralston Avenue, Harbor Boulevard and Holly Street	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable	Not applicable	Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 traffic lane along Pacific Boulevard; Improved traffic conditions with grade separation at 25th Avenue	Loss of 1 traffic lane along Pacific Boulevard; Improved traffic conditions with grade separation at 25th Avenue	Loss of 1 to 4 traffic lanes along Pacific Boulevard	Loss of 1 to 4 traffic lanes along Pacific Boulevard	Loss of 1 to 4 traffic lanes along Pacific Boulevard	Loss of 1 to 4 traffic lanes along Pacific Boulevard	None
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	0.40 acres	0.40 acres	Lower impacts than Berm option	Lower impacts than Trench option	Lower impacts than Trench option	0.31 acres	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	None	None				
	Cultural resources	Number of historic structures within ultimate ROW	None	None	3	3	3	3	Lower impacts than other options, depending on siting of vent structures and tunnel portals

Evaluation Measure			4A - North of Highway 92 to South of 25th Avenue		4B - South of 25th Avenue to South of Cordilleras Creek				
			At Grade	Berm	Aerial Viaduct	Berm	At Grade	Covered Trench/Tunnel	Deep Tunnel (HST Only)
		Archeological Sensitivity (identified as present or not)	Present	Present	Present; lower impacts than Covered Trench/Tunnel option	Present; lower impacts than Covered Trench/Tunnel option	Present; lower impacts than Covered Trench/Tunnel option	Present	Present; lower impacts than other options, depending on the siting of vent structures, tunnel portals, and tunnel depth
	Parklands	Acres of parklands within ultimate ROW	0.04	0.04	None	None	None	None	None
	Agricultural lands	Acres of farmland	Not applicable	Not applicable	Not applicable				
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	Lower impacts than Berm option	R=21-40, I<5, M<5, P<5	R=501-700, I<=5, S<5, P<5	R R=501-700, I<=5, S<5P=11-20; M=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than Berm option	R=11-20, I<5, M<5, P<5	Lower impacts than At Grade options	Lower impacts than At Grade option	R=201-300, S<5	Lower impacts than Berm and Aerial Viaduct options	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	P<5	P<5	R=101-200	R=101-200	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	None	None	5	5	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	12%	12%	1%	1%	1%	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	0/8	0/8	Lower impacts than Covered Trench/Tunnel option	Lower impacts than Covered Trench/Tunnel option	Lower impacts than Covered Trench option	4/40	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures, tunnel portals, and tunnel depth
Alternative Carried Forward into EIR/EIS			No	Yes	Yes	Yes	No	No	No

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Subsection 4 (continued)

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					Same for all options					
		Route length	Same for all options					Same for all options					
	Maximize connectivity and accessibility	Intermodal connections	Not applicable					Same for all options					
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm option, due to aerial structure	Lowest	Higher than Berm option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	200 million	-	308 million	765 million	336 million	70 million	-	9 million	103 million	280 million	121 million
		Acquisition cost of additional ROW	Medium	Medium	Medium	Lowest	Lowest	Medium	Medium	Highest	Medium	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options except Deep Tunnel (Potential Redwood City station in this subsection)					Not applicable					
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Inconsistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Inconsistent with adopted plans and policies			Consistent with adopted plans and policies	Inconsistent with adopted plans and policies; strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Inconsistent with adopted plans and policies	Consistent with adopted plans and policies		

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	**Berm**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Aerial Viaduct**	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**
Construct-ability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Medium; Nominal width with TCE for this option is 103'. Approximately 90% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 109'. Approximately 90% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	Medium; Nominal width with TCE for this option is 120'. Approximately 70% of existing ROW less than 100'	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Existing ROW less than 100' throughout this subsection	Low; Nominal width with TCE for this option is 109'. Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW	Low; Existing ROW less than 100' throughout this subsection	Low; Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Redwood City Harbor Lead					Redwood Junction Leads (Dumbarton Line)	Redwood Junction Leads (Dumbarton Line)	Redwood Junction Leads (Dumbarton Line)	Redwood Junction Leads (Dumbarton Line)		
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None					None					
	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Approximately 45% of subsection has existing ROW <70' and 55% over 80'	Low; Nominal width for this option is 85'. Approximately 45% of subsection has existing ROW <70', 45% between 80'-89' and 10% over 100'	Low; Nominal width for this option is 96'. Approximately 90% of subsection has existing ROW <90' and 10% over 100'	Low; Nominal width for this option is 96'. Approximately 90% of subsection has existing ROW <90'; Possibly some due to ventilation structures	Possibly some due to ventilation structures	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Low; Nominal width for this option is 85'. Approximately 50% of subsection has existing ROW <80' and 50% between 80'-89'	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Low; Approximately 50% of subsection has existing ROW between 70'-79' and 50% over 80'	Possibly some due to ventilation structures
Disruption to Communities	Properties with access affected	Properties with access affected	None					None					
	Local traffic effects around station	Increase in traffic congestion	Same for all options					Not applicable					
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 to 2 traffic lanes along Old Country Road	Loss of 1 to 2 traffic lanes along Old Country Road; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Loss of 1 to 2 traffic lanes along Old Country Road	Loss of 1 to 2 traffic lanes along Old Country Road	None	None					

Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm options	Lower impacts than Trench options	0.13 acres	0.13 acres	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	None					
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None					None					
	Cultural resources	Number of historic structures within ultimate ROW	5	5	5	5	Lower impacts than other options, depending on siting of vent structures and tunnel portals	None					
		Archeological Sensitivity (identified as present or not)	Present					None					
	Parklands	Acres of parklands within ultimate ROW	0.06 (two parks)	0.06 (two parks)	0.06 (two parks)	0.06 (two parks)	Lower impacts than other options, depending on siting of vent structures and tunnel portals	None					
	Agricultural lands	Acres of farmland	Not applicable					Not applicable					
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I=5-10, M=5-10, S<5, P=5-10	R=301-500, I=5-10, M=5-10, S<5, P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals	R=21-40, M<5, P<5	R=21-40, M<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Open Trench option	Lower impacts than Open Trench option

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Evaluation Measure			4C - South of Cordilleras Creek to North of Woodside Road					4D - North of Woodside Road to North of 5th Avenue					
			Aerial Viaduct	Berm	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=201-300, I<5, M<5, S<5, P<5	R=201-300, I<5, M<5, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than At Grade option	Lower impacts than At Grade option	R=11-20, M<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options depending on siting of vent structures, tunnel portals and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=61-100, P<5	R=61-100, P<5; Strong community perception of significant “barrier effect” from berm structure though this area	Minimal impacts	Minimal impacts	None	R=5-10	R=5-10; Strong community perception of significant “barrier effect” from berm structure though this area	R=5-10	Minimal impacts	Minimal impacts	None
		Number of scenic roadways that cross the ROW	None					None	None	1	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	3%	3%	Minimal impacts, lower impacts than Aerial Viaduct and Berm options	Minimal impacts, lower impacts than Aerial Viaduct and Berm options	Minimal impacts, lower impacts than Aerial Viaduct and Berm options	0%	0%	0%	0%	0%	0%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	6/29	6/29	Lower impacts than Trench options	None					
Alternative Carried Forward into EIR/EIS			Yes	No	No	No	No	No	No	Yes	No	No	No

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Subsection #5

Length: 2.8 miles Land Use: Urban

North of 5th Avenue to North of SCL/SM County Line (MP. 26.88 to MP. 29.72)
This subsection is located in the Cities of Atherton and Menlo Park, with a small portion in unincorporated San Mateo County. The Caltrain tracks are at-grade, and with one exception, all street crossings are at-grade. Generally, the streets that cross the tracks are two-lane collectors serving residential areas. In most cases, these streets are integral parts of the local street network.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

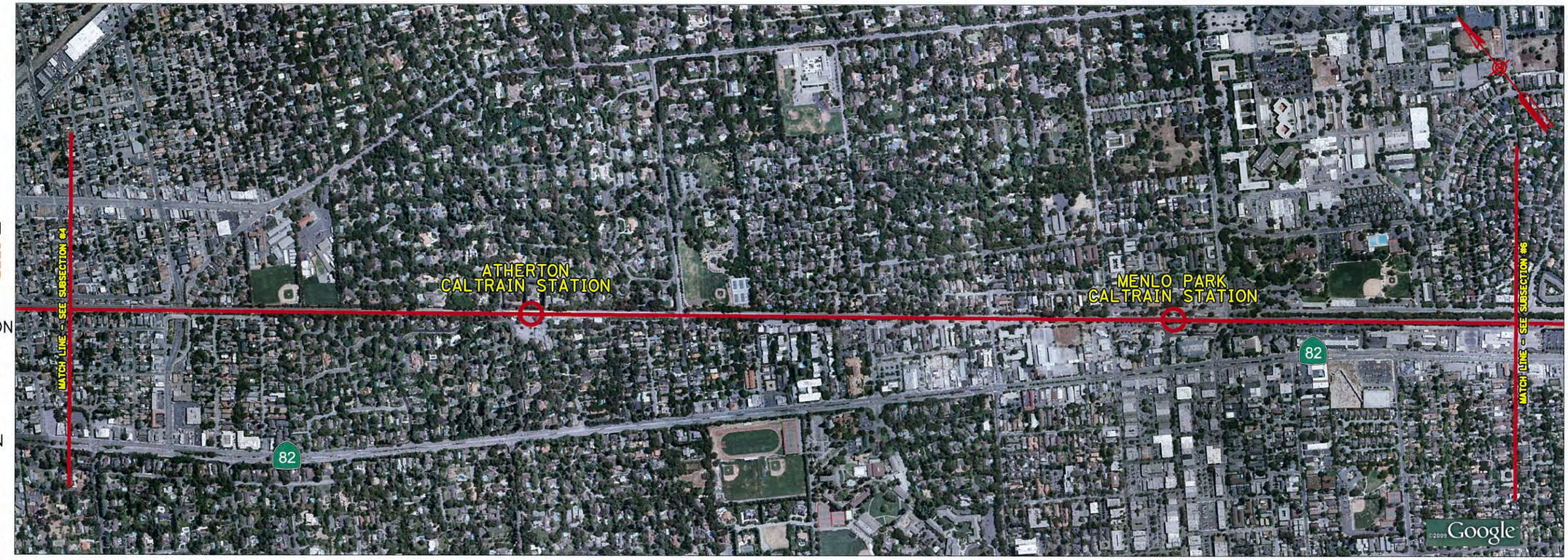
CALTRAIN STATION DESIGN OPTION

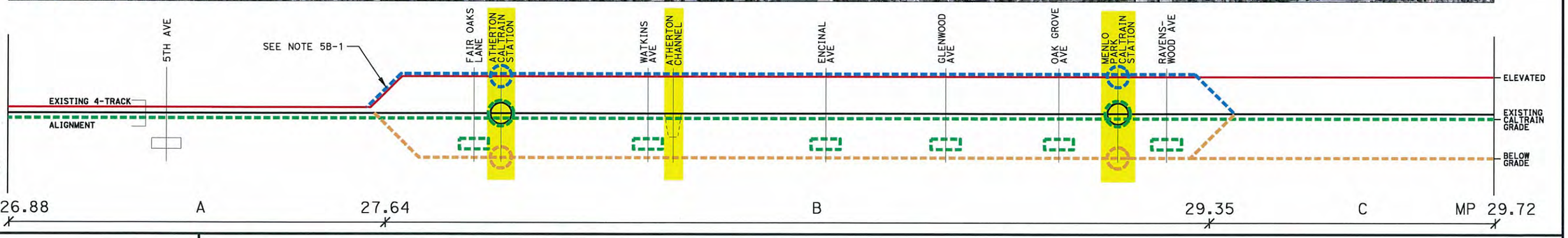
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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Without ever leaving the ground.

San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

4.3.6 Subsection 5 – Atherton and Menlo Park

This section has been modified to read as follows:

Options Considered

- Subsection 5A – North of 5th Avenue to South of 5th Avenue
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
- Subsection 5B – South of 5th Avenue South of Ravenswood Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
  - Hybrid
- Subsection 5C – South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
  - Hybrid

Vertical Profile Feasibility Notes

Note	Issue	Description
5B-1	Adjusted	Unable to begin elevated transition from at-grade after 5th Ave due to clearance constraints (to avoid roadway modification) at Fair Oaks Avenue.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 5A: At Grade.
- 5B: Aerial Viaduct, Open Trench. The Open Trench option would need to be below the existing utilities in the roadways crossing the corridor as well as below the Atherton Channel.
- 5C: At Grade, Open Trench. The hotel on the west side of the corridor, just north of San Francisquito Creek, would be affected for the Open Trench option.

Options Not Carried Forward

The following options are not to be carried forward for the reasons listed below:

- 5A: The Open Trench and Covered Trench/Tunnel options were added to the evaluation at the request of the North Fair Oaks community. These options do not allow for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur to occur at-grade. The Open Trench and Covered Trench/Tunnel options would require converting approximately 3,000 feet of the Dumbarton branch to a trench to accommodate a transition from the Caltrain corridor. The Port of Redwood City spur would have to be converted to a trench (open, partially covered, or completely covered) for approximately 6,000 feet (to the east side of US 101) to accommodate a transition from the Caltrain corridor. This would include a 1300-foot long segment along a 40-foot wide residential street. Access to properties in this segment would be constrained during the construction period, which could be several years.
- 5B: Berm, At Grade, Covered Trench/Tunnel, Deep Tunnel, Hybrid. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench option. The At Grade option would have substantial displacement impacts due to right-of-way acquisition requirements. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the “Options Not Carried Forward” discussion for Subsection 3A for more details). The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features (see the “Options Not Carried Forward” discussion for Subsections 4B(2)-4C for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the “Options Not Carried Forward” discussion for Subsection 3A for more details).
- 5C: Covered Trench/Tunnel, Deep Tunnel (HST Only), Hybrid. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the “Options Not Carried Forward” discussion for Subsection 3A for more details). The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features (see the “Options Not Carried Forward” discussion for Subsections 4B(2)-4C for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the “Options Not Carried Forward” discussion for Subsection 3A for more details).

Table 4-5
Summary Comparison of Design Options for Subsection 5 – Atherton, Menlo Park

Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue				5B - South of 5th Avenue to South of Ravenswood Avenue						
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				Same for all options						
		Route length	Same for all options				Same for all options						
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				Not applicable						
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than At Grade option, due to ventilation, life safety, etc	Higher than At Grade option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	11 million	223million	402 million	151 million	224 million	-	98 million	362 million	848 million	524 million	1,058 million
		Acquisition cost of additional ROW	Highest	Medium	Lowest	Lowest	Medium	Medium	Highest	Medium	Lowest	Lowest	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				Not applicable						
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies				Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies				

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Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue				5B - South of 5th Avenue to South of Ravenswood Avenue						
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 120'.	Medium; Nominal width with TCE for this option is 120'.	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Medium; Nominal width with TCE for this option is 103'. Existing ROW less than 100' throughout this subsection	Medium; Nominal width with TCE for this option is 109'. Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW	Medium; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection	Medium; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Medium; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None	Port of Redwood City spur, Dumbarton Branch			None						
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None				None						
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection	Medium; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection	Low; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures	Medium; Nominal width for this option is 79'. Approximately 15% of subsection has existing ROW <70', 20% between 70'-79' and 65% over 80'	Medium; Nominal width for this option is 85'. Approximately 35% of subsection has existing ROW <80' and 65% between 80'-90'	High; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection, also impacts due to grade separations at Fair Oaks Lane, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue and Ravenswood Avenue	Medium; Nominal width for this option is 96'. Existing ROW <90' throughout this subsection	Medium; Nominal width for this option is 96. Existing ROW <90' throughout this subsection; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures	Medium; Nominal width for this option is 70'. Existing ROW <90' throughout this subsection; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None				None	None	Access for properties affected due to grade separations	None	None	None	None

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Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue				5B - South of 5th Avenue to South of Ravenswood Avenue						
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
	Local traffic effects around station	Increase in traffic congestion	Not applicable				Not applicable						
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None				Loss of one traffic lane on Alma Street between Oak Grove Avenue and Ravenswood Avenue; improved traffic conditions with grade separations at Fair Oaks Lane, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue and Ravenswood Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			Improved traffic conditions with grade separations at Fair Oaks Lane, Watkins Avenue, Encinal Avenue, Glenwood Avenue, Oak Grove Avenue and Ravenswood Avenue	Same as Aerial Viaduct option
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None				Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	0.04 acres	0.04 acres	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	0.04 acres
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None				None						
	Cultural resources	Number of historic structures within ultimate ROW	None				5	5	53	5	5	Lower impacts than other options, depending on siting of vent structures and tunnel portals	5; depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	None				Present						

Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue				5B - South of 5th Avenue to South of Ravenswood Avenue						
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
	Parklands	Acres of parklands within ultimate ROW	None				0.53 (two facilities)	0.53 (two facilities)	0.53 (two facilities)	0.53 (two facilities)	0.53 (two facilities)	Lower impacts than other options, depending on siting of vent structures and tunnel portals	0.53 (two facilities); depending on siting of vent structures and tunnel portals
	Agricultural lands	Acres of farmland	Not applicable				Not applicable						
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300,P=5-10; M<5	Lower impacts than At Grade option	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	R=301-500, I<5, M<5, S<5, P<5	R=301-500, I<5, M<5, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals	Lower impacts than Open Trench and Covered Trench options, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=101-200, P<5	Lower impacts than At Grade option	Lower impacts than At Grade option	Lower impacts than At Grade option	Lower impacts than At Grade option	Lower impacts than At Grade option	R=201-300, I<5-, M<5, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than Aerial Viaduct, Berm, and Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=41-60	Minimal impacts	Minimal impacts	Minimal impacts	R=101-200, I<5, P<5, S<5	R=101-200, I<5, P<5, S<5; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	None				1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with geological and	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	0%	0%	0%	0%	Minimal impacts	Minimal impacts	Minimal impacts	Minimal impacts

Evaluation Measure			5A - North of 5th Avenue to South of 5th Avenue				5B - South of 5th Avenue to South of Ravenswood Avenue						
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
	soils constraints												
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/ within 1/4 mile of ultimate ROW	None				Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	1/5	1/5	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	1/5; depending on siting of vent structures, tunnel portals, and tunnel depth
Alternative Carried Forward into EIR/EIS			Yes	No	No	No	Yes	No	No	Yes	No	No	No

Subsection 5 Continued

Evaluation Measure			5C - South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line				
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options				
		Route length	Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Lowest	Higher than At Grade option, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	20 million	302 million	623 million	408 million	786 million
		Acquisition cost of additional ROW	Highest	Lowest	Medium	Lowest	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies				

Evaluation Measure			5C - South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line				
			At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 90% of existing ROW over 100'. Public ROW available	Low; Nominal width with TCE for this option is 120'. Approximately 90% of existing ROW over 100'. Public ROW available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Nominal width with TCE for this option is 120'. Approximately 90% of existing ROW over 100'. Public ROW available; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	None				
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None				
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW <90' and 90% over 100'	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW between 80'-90' and 90% over 100'	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW between 80'-90' and 90% over 100'	Low; Possibly some due to ventilation structures	Low; Nominal width for this option is 96'. Approximately 10% of subsection has existing ROW between 80'-90' and 90% over 100'; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Possibly some due to ventilation structures	Possibly some due to ventilation structures	Possibly some due to ventilation structures
	Local traffic effects around station	Increase in traffic congestion	Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None				
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None	Would have adverse effects on San Francisquito Creek in Subsection 6A	None		Would have adverse effects on San Francisquito Creek in Subsection 6A
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None	Would have adverse effects on San Francisquito Creek in Subsection 6A	None		Would have adverse effects on San Francisquito Creek in Subsection 6A
	Cultural resources	Number of historic structures within ultimate ROW	None				
		Archeological Sensitivity (identified as present or not)	None				
	Parklands	Acres of parklands within ultimate ROW	None				
	Agricultural lands	Acres of farmland	Not applicable				

Evaluation Measure			5C - South of Ravenswood Avenue to North of San Mateo County/Santa Clara County Line				
			At Grade	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	I/P<5	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	None				
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	None				
		Number of scenic roadways that cross the ROW	None				
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	No impacts	No impacts	No impacts	No impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None				
Alternative Carried Forward into EIR/EIS			Yes	Yes	No	No	No

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Subsection #6

Length: 3.9 miles Land Use: Urban

North of SCL/SM County Line to North of Adobe Creek (MP. 29.72 to MP. 33.61)
This subsection is located in the City of Palo Alto. The Caltrain tracks are at-grade and all of the streets that are grade separated pass under the tracks. Several at-grade crossings occur between the grade separations. Alma Street runs alongside the Caltrain tracks for the entire length of this subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

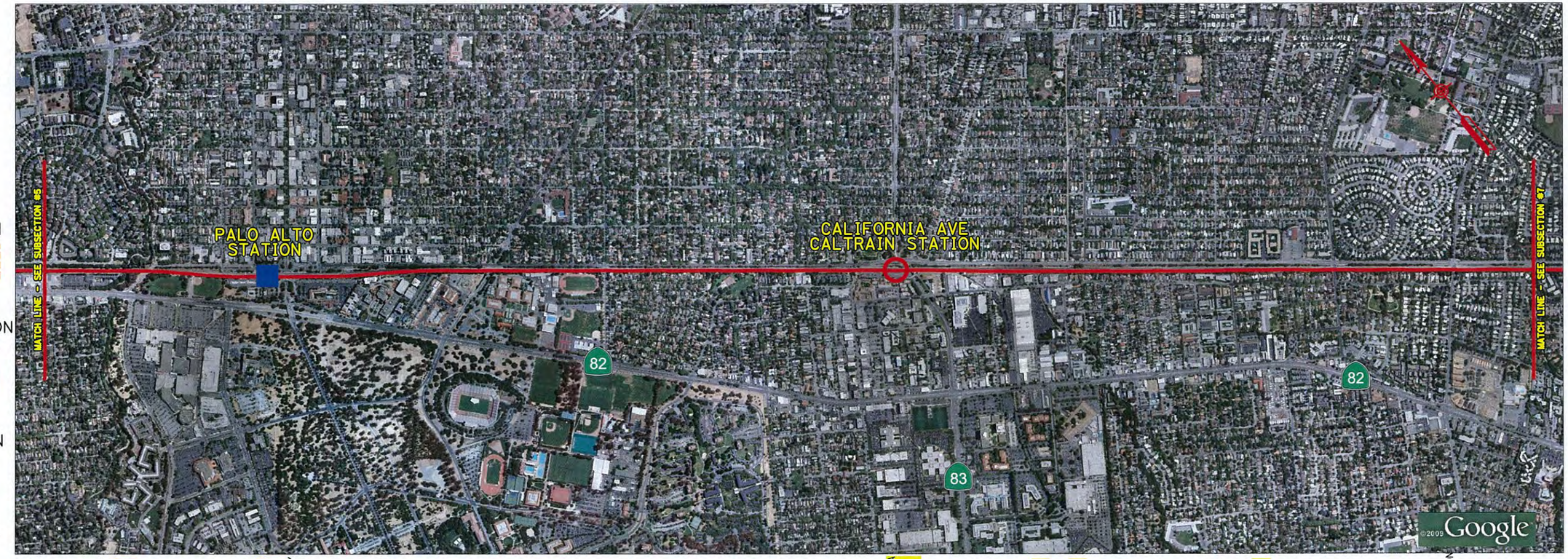
CALTRAIN STATION DESIGN OPTION

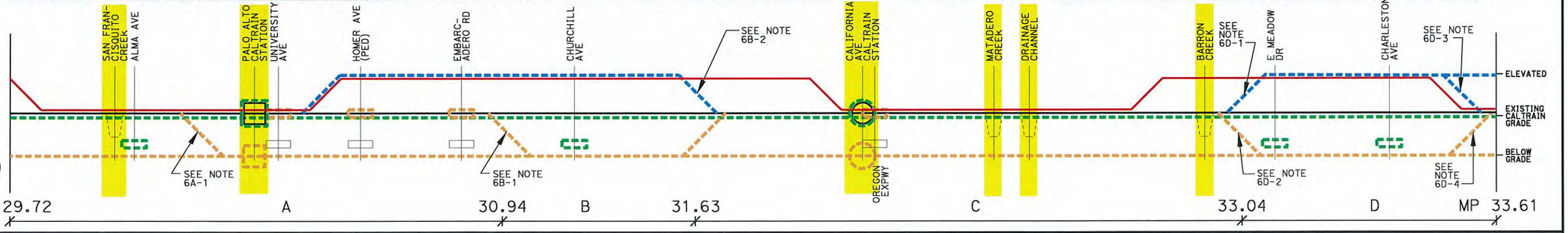
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

4.3.7 Subsection 6 – Palo Alto

This section has been modified to read as follows:

Options Considered

- Subsection 6A – North of San Mateo County/Santa Clara County Line to South of Embarcadero Road
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST only)
  - Hybrid
- Subsection 6B – South of Embarcadero Road to South of Churchill Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
  - Hybrid
- Subsection 6C – South of Churchill Avenue to North of East Meadow Drive
  - Aerial Viaduct
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
  - Hybrid
- Subsection 6D – North of East Meadow Drive to North of Adobe Creek
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Deep Tunnel (HST Only)
  - Hybrid

Vertical Profile Feasibility Notes

Note	Issue	Description
6A- 1	Eliminated	Limited room between horizontal curves and potential HST Station (Palo Alto Caltrain Station).
6B- 1	Eliminated	Unable to clear Churchill due to horizontal curves.
6B- 2	Adjusted	Unable to meet at grade before California Avenue Caltrain Station due to clearance of Churchill Avenue.
6D- 1	Adjusted	Unable to start vertical curve after Barron Creek due to horizontal curves and California Avenue Caltrain station.
6D- 2	Eliminated	Unable to clear East Meadow Drive completely and unable to extend further back due to Barron Creek.
6D- 3	Adjusted	Unable to meet at grade before Adobe Creek due to Charleston Road clearance and horizontal curves.
6D- 4	Adjusted	Unable to meet at grade before Adobe Creek due Barron Creek clearance.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 6A: At Grade, Open Trench. This subsection includes the Palo Alto Caltrain station, which is a location option for the potential Mid-Peninsula HST station. Where the Open Trench option crosses San Francisquito Creek, the tracks could be placed in a short tunnel under the creek. Alternatively, a creek crossing of the trench could be constructed by temporarily dewatering the creek. Both options will be studied further in the preliminary engineering effort.
- 6B: Aerial Viaduct, Open Trench.
- 6C: At Grade, Open Trench.
- 6D: Aerial Viaduct, Open Trench.

Options Not Carried Forward

The following options are not to be carried forward for the reasons listed below:

- 6A: Aerial Viaduct, Covered Trench/Tunnel, Berm, Deep Tunnel, Hybrid. The Aerial Viaduct option would have substantial impacts on the existing El Palo Alto tree, San Francisquito Creek, and the historic Palo Alto Caltrain station. The Berm option does not enhance connectivity and mobility as well as an open trench option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the “Options Not Carried Forward” discussion for Subsection 3A for more details). The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions,

have major constructability issues, lengthy construction schedule, and substantial capital cost features (see the "Options Not Carried Forward" discussion for Subsections 4B(2)-4C for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).

- 6B: At Grade, Berm, Covered Trench/Tunnel, Deep Tunnel, Hybrid. The At Grade option would have substantial displacement impacts due to right-of-way acquisition requirements. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features (see the "Options Not Carried Forward" discussion for Subsections 4B(2)-4C for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).
- 6C: Aerial Viaduct, Covered Trench/Tunnel, Deep Tunnel, Hybrid. Additional engineering studies indicate that the transition from the Aerial Viaduct option over Churchill Avenue in Subsection 6B can be completely accomplished within that subsection. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features (see the "Options Not Carried Forward" discussion for Subsections 4B(2)-4C for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).
- 6D: At Grade, Berm, Covered Trench/Tunnel, Deep Tunnel, Hybrid. The At Grade option would have substantial displacement impacts due to right-of-way acquisition requirements. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features (see the "Options Not Carried Forward" discussion for Subsections 4B(2)-4C for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).

Table 4-6
Summary Comparison of Design Options for Subsection 6 – Palo Alto

Evaluation Measure			6A - North of San Mateo County/Santa Clara County Line to South of Embarcadero Road						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options						
		Route length	Same for all options						
	Maximize connectivity and accessibility	Intermodal connections	Same for all options						
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to retaining walls, drainage, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	-	-	75 million	265 million	593 million	373 million	750 million
		Acquisition cost of additional ROW	Medium	Medium	Low	Low	Medium	Lowest	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options (Potential Palo Alto HST station in this subsection)						
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW is over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW is over 100'. Public ROW is available; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable						

Evaluation Measure			6A - North of San Mateo County/Santa Clara County Line to South of Embarcadero Road						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable						
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW over 80' throughout this subsection	Low; Nominal width for this option is 85'. Approximately 25% of subsection has existing ROW between 80'-89' and 75% over 100'	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100', possible impacts due to grade separation at Alma Street	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100', Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW is over 100'. Public ROW is available; possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separation at Alma Street	None	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Same for all options (Potential Palo Alto HST station in this subsection)	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 traffic lane along Alma Street; improved traffic conditions with grade separation at Alma Street	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Same as Aerial Viaduct option	Improved traffic conditions with grade separation at Alma Street	Same as Aerial Viaduct option
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	0.06	0.06	Lower impacts than Aerial Viaduct options, depending on siting of vent structures, tunnel portals, and tunnel depth	0.06; Lower impacts than Aerial Viaduct options, depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	Present, would have adverse effects on San Francisquito Creek; lower impacts than Berm option	Present, San Francisquito Creek; lower impacts than Trench options	Present, San Francisquito Creek; lower impacts than Trench options	Present, San Francisquito Creek; lower impacts than Covered Trench and Tunnel options	Present, San Francisquito Creek	Present, San Francisquito Creek; lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	Present, San Francisquito Creek; lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Cultural resources	Number of historic structures within ultimate ROW	3	3	3	3	3	Lower impacts than other options, depending on siting of vent structures and tunnel portals	3; depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present	Present; Lower impacts than other options, depending on siting of vent structures, tunnel portals, and tunnel depth	Present; depending on siting of vent structures and tunnel portals

Evaluation Measure			6A - North of San Mateo County/Santa Clara County Line to South of Embarcadero Road						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
	Parklands	Acres of parklands within ultimate ROW	0.25 (two facilities)	0.25 (two facilities)	0.25 (two facilities)	0.25 (two facilities)	0.25 (two facilities)	Lower impacts than other options, depending on siting of vent structures and tunnel portals	0.25 (two facilities); depending on siting of vent structures and tunnel portals
	Agricultural lands	Acres of farmland	Not applicable						
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I=5-10, M<5, S<5,P=5-10	R=201-300, I=5-10, M<5, S<5,P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option; depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, I<5, M<5, S<5, P=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than Aerial Viaduct and Berm options; depending on siting of vent structures and tunnel portals
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	None	Strong community perception of significant “barrier effect” from berm structure though this area	R=101-200	Minimal impacts			
		Number of scenic roadways that cross the ROW	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts			
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	21%	21%	21%	Minimal impacts			
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	1/8	1/8	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	1/8; depending on siting of vent structures and tunnel portals
Alternative Carried Forward into EIR/EIS			No	No	Yes	Yes	No	No	No

US Department of Transportation
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Subsection 6 Continued

Evaluation Measure			6B - South of Embarcadero Road to South of Churchill Avenue						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options						
		Route length	Same for all options						
	Maximize connectivity and accessibility	Intermodal connections	Not applicable						
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to retaining walls, drainage, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	71 million	-	41 million	127 million	321 million	211 million	406 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest	Lowest	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable						
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Nominal width with TCE for this option is 120'. Existing ROW less than 100' throughout this subsection. Public ROW is available; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable						
	Disruption / relocation of utilities	Identify major utilities requiring relocation	None	None	None	Two 24" RCP water lines near Churchill Avenue	Two 24" RCP water lines near Churchill Avenue	None	Two 24" RCP water lines near Churchill Avenue

Evaluation Measure			6B - South of Embarcadero Road to South of Churchill Avenue						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Approximately 25% of subsection has existing ROW <70', 40% between 70'-79' and 35% over 80'	Low; Nominal width for this option is 85'. Approximately 65% of subsection has existing ROW <80' and 35% between 80'-89'	Medium; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection and possible impacts due to grade separation at Churchill Avenue	Low; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection	Low; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures	Low; Nominal width for this option is 96'. Existing ROW is <90' throughout this subsection; possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separation at Churchill Avenue	None	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable						
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 2 traffic lanes along Alma Street; improved traffic conditions with grade separation at Churchill Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			Improved traffic conditions with grade separation at Churchill Avenue	Same as Aerial Viaduct option
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None						
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None						
	Cultural resources	Number of historic structures within ultimate ROW	1	1	1	1	1	Lower impacts than other options, depending on siting of vent structures and tunnel portals	1; depending on siting of vent structures and tunnel portals
		Archeological Sensitivity (identified as present or not)	None						
	Parklands	Acres of parklands within ultimate ROW	0.17	0.17	0.17	0.17	0.17	Lower impacts than other options, depending on siting of vent structures and tunnel portals	0.17; depending on siting of vent structures and tunnel portals
	Agricultural lands	Acres of farmland	Not applicable						
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of	R=201-300, S<5, P<5	R=201-300, S<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option; depending on siting of vent structures and tunnel portals

Evaluation Measure			6B - South of Embarcadero Road to South of Churchill Avenue						
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
		ultimate ROW							
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than At Grade option; depending on siting of vent structures and tunnel portals
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=61-100	R=65; Strong community perception of significant "barrier effect" from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	Minimal impacts	Minimal impacts	Minimal impacts
		Number of scenic roadways that cross the ROW	None						
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	Minimal impacts	Minimal impacts	Minimal impacts	Minimal impacts
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None						
Alternative Carried Forward into EIR/EIS			Yes	No	No	Yes	No	No	No

Subsection 6 Continued

Evaluation Measure			6C - South of Churchill Avenue to North of East Meadow Drive					
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					
		Route length	Same for all options					
	Maximize connectivity and accessibility	Intermodal connections	Not applicable					

CALIFORNIA HIGH-SPEED RAIL AUTHORITY
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Evaluation Measure			6C - South of Churchill Avenue to North of East Meadow Drive					
			Aerial Viaduct	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Lowest	Higher than At Grade options, due to retaining walls, drainage, ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than At Grade options, due to retaining walls, drainage, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	122 million	46 million	263 million	692 million	438 million	869 million
		Acquisition cost of additional ROW	Medium	Highest	Medium	Lowest	Lowest	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable					
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies					
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 50% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 50% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 50% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Nominal width with TCE for this option is 120'. Approximately 50% of existing ROW over 100'. Public ROW is available; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable					
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable					
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW is >80' throughout this subsection	Low; Nominal width for this option is 96'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'	Low; Nominal width for this option is 96'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'	Low; Nominal width for this option is 96'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures	Low; Nominal width for this option is 70'. Approximately 55% of subsection has existing ROW <90' and 45% is over 100'; possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None					
	Local traffic effects around station	Increase in traffic congestion	Not applicable					
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of 1 to 2 traffic lanes along Alma Street				None	Loss of 1 to 2 traffic lanes along Alma Street
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Trench options	Lower impacts than Trench options	0.25 acres	0.25 acres	Lower impacts than At-Grade option	0.25 acres

Evaluation Measure			6C - South of Churchill Avenue to North of East Meadow Drive					
			Aerial Viaduct	At Grade	Open Trench	Covered Trench/Tunnel	Deep Tunnel (HST Only)	Hybrid
	habitat areas affected	Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None					
	Cultural resources	Number of historic structures within ultimate ROW	None					
		Archeological Sensitivity (identified as present or not)	Present; Lower impacts than Trench options	Present; Lower impacts than Trench options	Present	Present	Present; Lower impacts than Trench options	Present
	Parklands	Acres of parklands within ultimate ROW	None					
	Agricultural lands	Acres of farmland	Not applicable					
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, P<5	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench option, depending on siting of vent structures and tunnel portals	Lower impacts than At-Grade option, depending on siting of vent structures, tunnel portals, and tunnel depth
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	R=101-200; I<5; P<5	Lower impacts than At Grade option	Lower impacts than At Grade option	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than At-Grade option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200; P<5	Lower impacts than Aerial Viaduct option	Minimal impacts			
		Number of scenic roadways that cross the ROW	1	1	Minimal impacts			
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	1%	1%	Minimal impacts			
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	2/6	2/6	Lower impacts than Trench options, depending on the siting of vent structures, tunnel portals, and tunnel depth	2/6; depending on the siting of vent structures, tunnel portals, and tunnel depth
Alternative Carried Forward into EIR/EIS			No	Yes	Yes	No	No	No

Subsection 6 Continued

Evaluation Measure			6D - North of East Meadow Drive to North of Adobe Creek						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options						
		Route length	Same for all options						
	Maximize connectivity and accessibility	Intermodal connections	Not applicable						
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to retaining walls, drainage, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	59 million	-	72 million	110 million	268 million	176 million	342 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Medium	Lowest	Lowest	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable						
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Nominal width with TCE for this option is 120'. Approximately 75% of existing ROW over 100'. Public ROW is available; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable						
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable						

Evaluation Measure			6D - North of East Meadow Drive to North of Adobe Creek						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Existing ROW is >80' throughout this subsection	Low; Nominal width for this option is 85'. Approximately 25% of subsection has existing ROW between 80'-89' and 75% is over 100'	Medium; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100', impacts due to grade separations at East Meadow Drive and Charleston Road	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'	Low; Nominal width for this option is 96'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'; Possibly some due to ventilation structures	Low; Possibly some due to ventilation structures	Low; Nominal width for this option is 70'. Approximately 25% of subsection has existing ROW <90' and 75% is over 100'; possible some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separations at East Meadow Drive and Charleston Road	None	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable						
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Improved traffic conditions with grade separations at East Meadow Drive and Charleston Road	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option				
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than Berm option	Lower impacts than Trench options	Lower impacts than Trench options	0.04	0.04	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	0.04; depending on siting of vent structures, tunnel portals, and tunnel depth
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None						
	Cultural resources	Number of historic structures within ultimate ROW	None						
		Archeological Sensitivity (identified as present or not)	Present; Lower impacts than Trench options	Present; Lower impacts than Trench options	Present; Lower impacts than Trench options	Present	Present	Present; Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Present; Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth
	Parklands	Acres of parklands within ultimate ROW	None						
	Agricultural lands	Acres of farmland	Not applicable						

Evaluation Measure			6D - North of East Meadow Drive to North of Adobe Creek						
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Deep Tunnel (HST Only)**	**Hybrid**
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, P<5	R=201-300, I<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than Covered Trench/Tunnel option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option ; depending on siting of vent structures, tunnel portals, and tunnel depth
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Trench options, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than Aerial Viaduct and Berm options; depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200	R=101-200; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts			
		Number of scenic roadways that cross the ROW	1	1	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts			
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	Minimal impacts			
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	None						
Alternative Carried Forward into EIR/EIS			Yes	No	No	Yes	No	No	No

Subsection #7

Length: 5.7 miles Land Use: Urban

North of Adobe Creek to North of Fair Oaks Avenue (MP. 33.61 to MP. 39.29)
This subsection is located in the Cities of Mountain View and Sunnyvale. The Caltrain tracks are at-grade and all grade separated crossings pass over the tracks. Several at-grade crossings occur between the grade separations. Central Expressway and Evelyn Avenue run alongside the Caltrain tracks for a large portion of this subsection.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

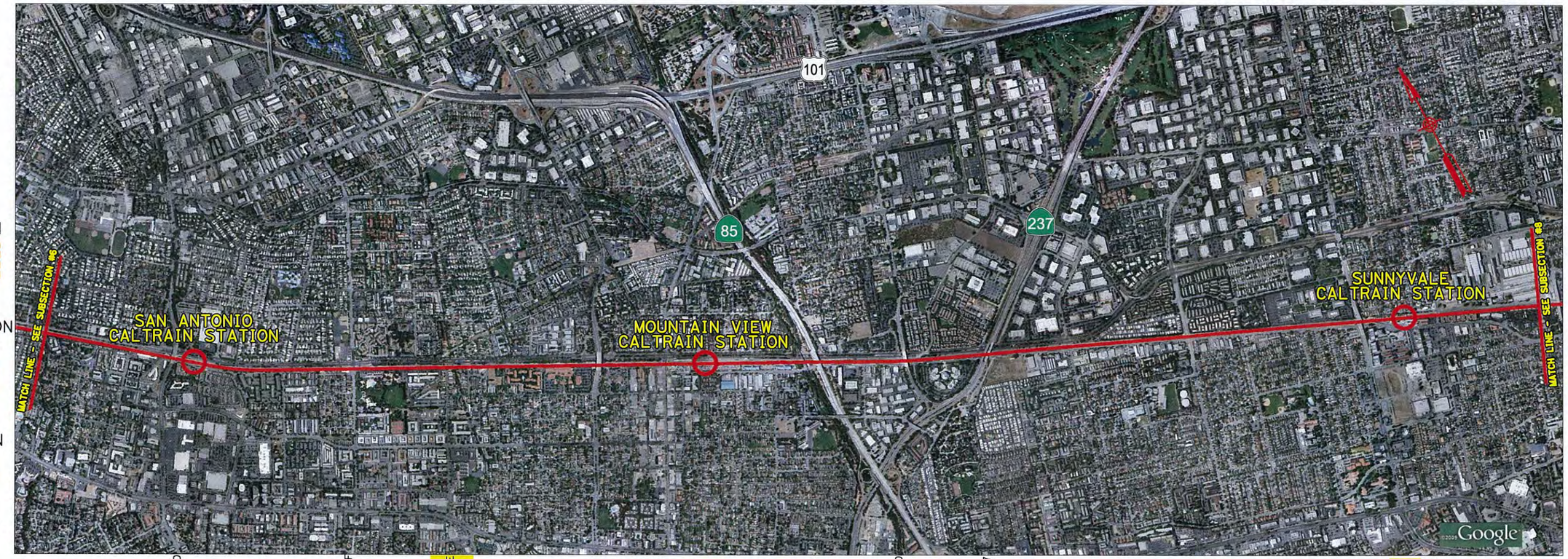
CALTRAIN STATION DESIGN OPTION

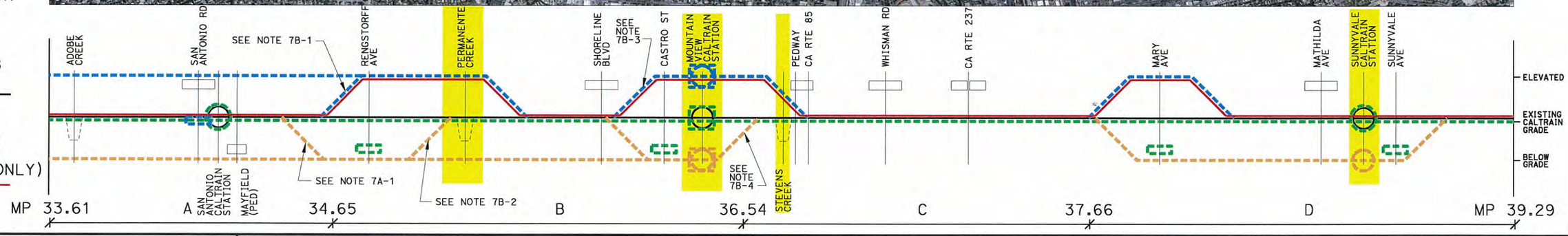
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





CALIFORNIA HIGH SPEED RAIL AUTHORITY
FLY CALIFORNIA
Without ever leaving the ground.

San Francisco - San Jose

DRAFT Preliminary Alternatives Discussion
February 1, 2010

NOT TO SCALE

4.3.8 Subsection 7 – Mountain View and Sunnyvale

This section has been modified to read as follows:

Options Considered

- Subsection 7A – North of Adobe Creek to north of Rengstorff Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid
- Subsection 7B – North of Rengstorff Avenue to north of Stevens Creek
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid
- Subsection 7C – North of Stevens Creek to south of SR-237
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 7D(1) – South of SR-237 to north of Mathilda Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
- Subsection 7D(2) – North of Mathilda Avenue to North of Fair Oaks Avenue
  - Aerial Viaduct
  - Berm
  - At Grade
  - Open Trench
  - Covered Trench/Tunnel
  - Hybrid

Vertical Profile Feasibility Notes

Note	Issue	Description
7A-1	Adjusted	Unable to start vertical curve after San Antonio station due to horizontal curves.
7B-1	Adjusted	Unable to clear Rengstorff Avenue due to horizontal curves and San Antonio station.
7B-2	Eliminated	Unable to meet at grade and clear Rengstorff Avenue.
7B-3	Adjusted	Unable to clear Castro Street completely due to Shoreline Boulevard. Shoreline Boulevard would have to be moved to grade.
7B-4	Adjusted	Unable to meet grade before Stevens Creek due to limited space between Stevens Creek and Mountain View station.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 7A: At Grade, Open Trench.
- 7B: At Grade, Open Trench. This subsection includes the Mountain View Caltrain station, which is a location option for the potential Mid-Peninsula HST station. The At Grade option may require moving VTA light rail to a below grade configuration.
- 7C: At Grade, Open Trench. The At Grade option may require moving VTA light rail to a below grade configuration.
- 7D(1): Aerial Viaduct, Open Trench.
- 7D(2): At Grade, Open Trench.

Options Not Carried Forward

The following options are not to be carried forward for the reasons listed below:

- 7A: Aerial Viaduct, Berm, Covered Trench/Tunnel, Hybrid. The Aerial Viaduct option would require converting the San Antonio Road overpass to an at grade configuration. The Berm option was not carried forward because it does not enhance connectivity and mobility as well as the trench option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).
- 7B: Aerial Viaduct, Berm, Covered Trench/Tunnel, Hybrid. The Berm option was not carried forward because it does not enhance connectivity and mobility as well as the trench option. The Aerial Viaduct option requires converting the Shoreline Boulevard overpass to an at grade configuration. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).
- 7C: Aerial Viaduct, Berm, Covered Trench/Tunnel. The Aerial Viaduct option would need to be above the SR-85, Whisman Road and SR-237 overpasses. The Berm option was not carried forward because it does not enhance connectivity and mobility as well as the trench option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).
- 7D(1): Berm, At Grade, Covered Trench/Tunnel. The Berm option was not carried forward because it does not enhance connectivity and mobility as well as the aerial viaduct or trench options. The At Grade option would have substantial displacement impacts due to right-of-way acquisition requirements. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).
- 7D(2): Aerial Viaduct, Berm, Covered Trench/Tunnel, Hybrid. The Aerial Viaduct option would need to be above the Mathilda Avenue overpass. The Berm option was not carried forward because it does not enhance connectivity and mobility as well as the trench option. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the "Options Not Carried Forward" discussion for Subsection 3A for more details). The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration (see the "Options Not Carried Forward" discussion for Subsection 3A for more details).

Table 4-7
Summary Comparison of Design Options for Subsection 7 – Mountain View, Sunnyvale

Evaluation Measure			7A & 7B - North of Adobe Creek to North of Stevens Creek					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					
		Route length	Same for all options					
	Maximize connectivity and accessibility	Intermodal connections	Same for all options					
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to retaining walls, drainage, ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	462 million	-	242 million	583 million	1,433 million	1,789 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Lowest	Medium	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Same for all options (Potential Mountain View HST station in this subsection)					
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 60% of existing ROW over 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable					
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable					

Evaluation Measure			7A & 7B - North of Adobe Creek to North of Stevens Creek					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is 79'. Exiting ROW is >90' throughout this subsection	Low; Nominal width for this option is 85'. Exiting ROW is >90' throughout this subsection	Medium; Nominal width for this option is 96'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100' and impacts due to the grade separations at Rengstorff Avenue and Castro Street	Low; Nominal width for this option is 96'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100'	Low; Nominal width for this option is 96'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100'; Possibly some due to ventilation structures	Low; Nominal width for this option is 70'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100'; possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separations at Rengstorff Avenue and Castro Street	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Same for all options (Potential Mountain View HST Station in this subsection)					
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of one traffic lane along Central Expressway, north of Rengstorff Avenue; improved traffic conditions with grade separations at Rengstorff Avenue and Moffett Boulevard	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	Lower impacts than the Berm option	Lower impacts than the Trench options	Lower impacts than the Trench options	0.07	0.07	0.07
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	Present, Permanente Creek; lower impacts than Berm option	Present, Permanente Creek; lower impacts than Trench options	Present, Permanente Creek; lower impacts than Trench options	Present, Permanente Creek	Present, Permanente Creek	Present, Permanente Creek
	Cultural resources	Number of historic structures within ultimate ROW	None					
		Archeological Sensitivity (identified as present or not)	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present; lower impacts than Trench options	Present	Present	Present
	Parklands	Acres of parklands within ultimate ROW	None					
	Agricultural lands	Acres of farmland	Not applicable					
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I=5-10, P<5	R=301-500, I=5-10, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Lower impacts than At Grade option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within	Lower impacts than At Grade option	Lower impacts than At Grade option	R=201-300, I<5, P<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options

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Evaluation Measure			7A & 7B - North of Adobe Creek to North of Stevens Creek					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
		200' of ultimate ROW						
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200, P<5	R=101-200, P<5; Strong community perception of significant "barrier effect" from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts		
		Number of scenic roadways that cross the ROW	5	5	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts		
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	1%	1%	1%	Minimal impacts		
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	1/7	1/7	1/7
Alternative Carried Forward into EIR/EIS			Yes	No	Yes	Yes	No	No

Subsection 7 Continued

Evaluation Measure			7C & 7D - North of Stevens Creek to North of Fair Oaks Avenue					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					
		Route length	Same for all options					
	Maximize connectivity and accessibility	Intermodal connections	Not applicable					
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Lowest	Lowest	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than Open Trench option, due to ventilation, life safety, etc	Higher than Berm and At Grade options, due to retaining walls, drainage, etc
		Capital cost ($ 2009), does not include ROW	449 million	-	345 million	510 million	1,323 million	1,162 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Lowest	Medium	Medium (affects other subsections)
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable					

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Evaluation Measure			7C & 7D - North of Stevens Creek to North of Fair Oaks Avenue					
			Aerial Viaduct	**Berm**	**At Grade**	**Open Trench**	**Covered Trench/Tunnel**	**Hybrid**
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies	Consistent with adopted plans and policies; Strong local opposition to this type of structure; the berm structure (wall) would create a perceived barrier through this area which is not consistent with the local communities' character and land uses	Consistent with adopted plans and policies			
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 103'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Nominal width with TCE for this option is 109'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable					
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable					
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Medium; Nominal width for this option is 79'. Approximately 10% of subsection has existing ROW <70', 60% between 70'-79' and 30% over 80'	Medium; Nominal width for this option is 85'. Approximately 70% of subsection has existing ROW <80', 10% between 80'-89' and 20% over 90'	Medium; Nominal width for this option is 96'. Approximately 80% of subsection has existing ROW <90', 5% between 90'-99' and 15% over 100'; impacts due to grade separations at Mary Avenue and Sunnyvale Avenue	Medium; Nominal width for this option is 96'. Approximately 80% of subsection has existing ROW <90', 5% between 90'-99' and 15% over 100'	Medium; Nominal width for this option is 96'. Approximately 80% of subsection has existing ROW <90', 5% between 90'-99' and 15% over 100'; Possibly some due to ventilation structures	Medium; Nominal width for this option is 70'. Approximately 40% of subsection has exiting ROW between 90'-99' and 60% over 100'; possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None	None	Access for properties affected due to the grade separations at Mary Avenue and Sunnyvale Avenue	None	None	None
	Local traffic effects around station	Increase in traffic congestion	Not applicable					
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	Loss of one traffic lane on Hendy Avenue; improved traffic conditions with grade separations at Mary Avenue and Sunnyvale Avenue	Same as Aerial Viaduct option; Does not enhance connectivity and mobility as well as an aerial viaduct option or trench or tunnel option	Same as Aerial Viaduct option			
Environmental Resources	Waterways and wetlands and natural preserves or	Waterways (acres of waterways within ultimate ROW)	None					

Evaluation Measure			7C & 7D - North of Stevens Creek to North of Fair Oaks Avenue					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/Tunnel	Hybrid
	biologically sensitive habitat areas affected	Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None					
	Cultural resources	Number of historic structures within ultimate ROW	None					
		Archeological Sensitivity (identified as present or not)	None					
	Parklands	Acres of parklands within ultimate ROW	None					
	Agricultural lands	Acres of farmland	Not applicable					
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, M=5-10	R=201-300, I<5, S<5, M=5-10	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than At Grade option	Lower impacts than Open Trench option	Same as Aerial Viaduct option
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, M=5-10, S<5	Lower impacts than Aerial Viaduct and Berm options	Lower impacts than Aerial Viaduct and Berm options	Same as Aerial Viaduct and Berm option
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=41-60	R=41-60; Strong community perception of significant “barrier effect” from berm structure though this area	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts		
		Number of scenic roadways that cross the ROW	0	0	2	Minimal impacts		
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	Minimal impacts		
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	Lower impacts than Trench options	Lower impacts than Trench options	Lower impacts than Trench options	0/5	0/5	0/5
Alternative Carried Forward into EIR/EIS			Yes	No	Yes	Yes	No	No

Subsection #8

Length: 4.7 miles Land Use: Urban

North of Fair Oaks Avenue to North of De La Cruz Boulevard (MP. 39.29 to MP. 44.04)
This subsection is located in the Cities of Sunnyvale and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Most of the crossings pass over the tracks. This subsection includes an existing 4-track segment near Lawrence Expressway.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

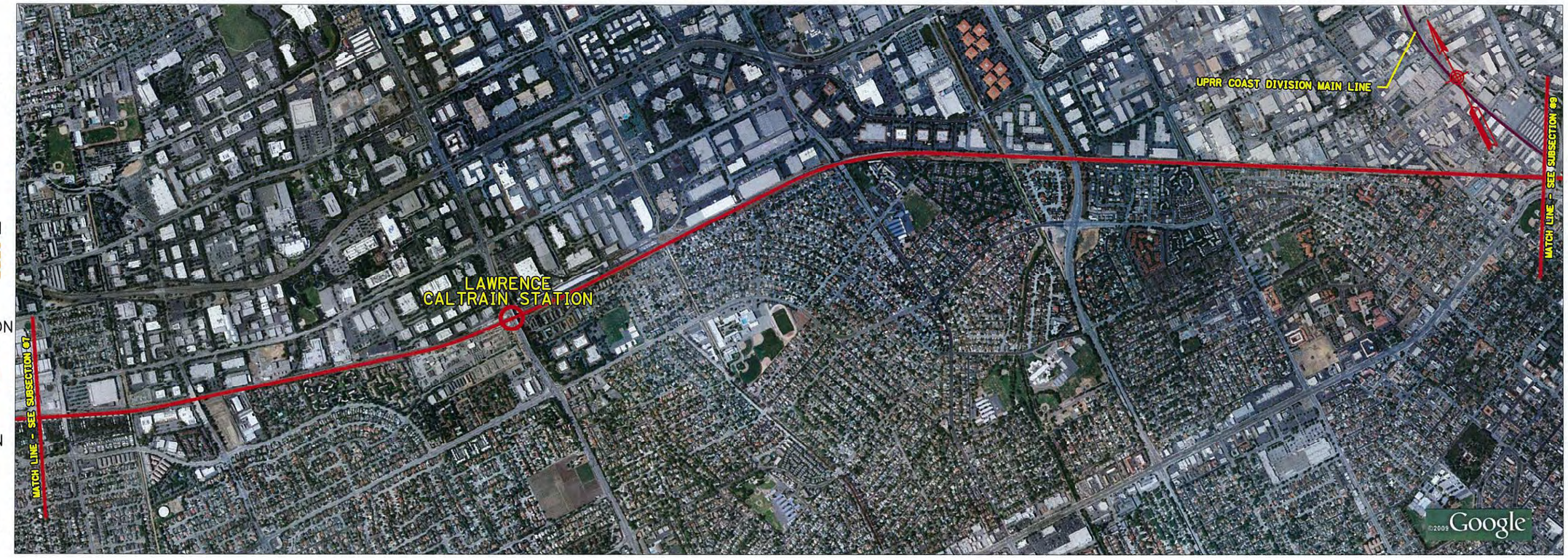
CALTRAIN STATION DESIGN OPTION

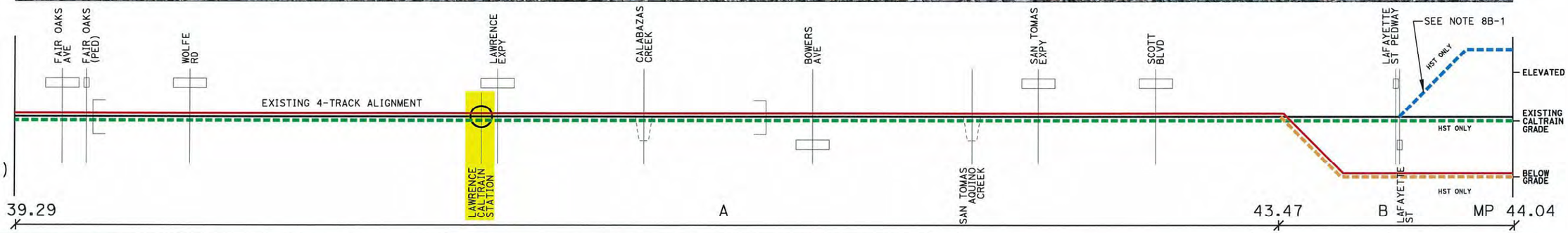
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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NOT TO SCALE

4.3.9 Subsection 8 – Sunnyvale and Santa Clara

This section has been modified to read as follows:

Options Considered

- Subsection 8A(1) – North of Fair Oaks Avenue to South of Lawrence Expressway
    - At Grade
    - Open Trench
- Subsection 8A(2) – South of Lawrence Expressway to South of Scott Boulevard
    - Aerial Viaduct (HST Only) – East Alignment
    - At Grade
    - Open Trench
- Subsection 8B – South of Scott Boulevard to North of De La Cruz Boulevard
    - Aerial Viaduct (HST Only) – West Alignment
    - Aerial Viaduct (HST Only) – East Alignment
    - At Grade (HST Only)
    - Covered Trench/Tunnel (HST Only)
    - Deep Tunnel (HST Only)

Vertical Profile Feasibility Notes

Note	Issue	Description
8B-1	Adjusted	Unable to start vertical curve after Lafayette Street due to height needed to clear De La Cruz Boulevard.

Options Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 8A(1): At Grade.
- 8A(2): Aerial Viaduct (HST Only) – East Alignment, At Grade. The Aerial Viaduct (HST Only) option would be located on a horizontal alignment east of the existing Caltrain tracks. The East Alignment is a refinement of the horizontal alignment presented in the Preliminary AA, which has been designated as the West Alignment. The East Alignment was developed in response to community concern regarding an elevated structure running next to residences. The East Alignment puts the aerial structure further away from the residences on the west side of the railroad tracks.
- 8B: Aerial Viaduct (HST Only) – East Alignment, Deep Tunnel (HST Only). Under the Aerial Viaduct (HST Only) and Deep Tunnel (HST Only) options, 2 tracks for Caltrain would remain at grade in their existing configuration. The other two tracks would either be in the Aerial Viaduct (HST Only) option or in the Deep Tunnel (HST Only) option.

Options Not To Be Carried Forward

- 8A(1): Open Trench. The City of Santa Clara requested that the project team study trench alternatives through portions of Subsections 8 and 9. In order to put the existing railroad in a trench, the project would need to remove the existing 2 miles of 4-track railroad and rebuild it in a trench. A trench option would also require changing several existing grade-separated roadways back to grade, and addressing several creek crossings in the subsection with either a deep trench or a tunnel.
- 8A(2): Open Trench.
- 8B: Aerial Viaduct (HST Only) – West Alignment, At Grade (HST Only), At Grade (HST Only), Covered Trench/Tunnel (HST Only), Deep Tunnel (HST Only).

Table 4-8
Summary Comparison of Design Options for Subsection 8 – Sunnyvale, Santa Clara

Evaluation Measure			8A - North of Fair Oaks Avenue to South of Scott Boulevard			8B - South of Scott Boulevard to North of De La Cruz Boulevard				
			Aerial Viaduct (HST Only) – East Alignment	At Grade	Open Trench	Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment	At Grade (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options			Same for all options				
		Route length	Same for all options			Same for all options				
	Maximize connectivity and accessibility	Intermodal connections	Not applicable			Not applicable				
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Higher than Berm and At Grade options, due to aerial structure	Low	Higher than Berm and At Grade options, due to retaining walls, drainage, etc	Higher than At Grade option, due to aerial structure	Higher than At Grade option, due to aerial structure	Lowest	Higher than Aerial Viaduct option, due to ventilation, life safety, etc	Higher than Aerial Viaduct option, due to ventilation, life safety, etc
		Capital cost ($ 2009), does not include ROW	379 million	103 million	1,126 million	42 million	40 million	7 million	150 million	113 million
		Acquisition cost of additional ROW	Medium	Highest	Medium	Medium	Medium	Highest	Lowest	Lowest
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable			Not applicable				
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies			Consistent with adopted plans and policies				
Constructability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Low; Nominal width with TCE for this option is 75'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Construction would primarily occur within ultimate ROW	Low; Nominal width with TCE for this option is 120'. Approximately 85% of existing ROW is less than 100'. Public ROW is available	Low; Approximately 85% of existing ROW is over 100'	Low; Approximately 85% of existing ROW is over 100'	Low; Construction would primarily occur within ultimate ROW	Low; Approximately 85% of existing ROW is over 100'	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations
	Disruption to existing railroads	Identify existing freight rail and other rail service	Calstone Lead and Butterhouse Lead connections			Not applicable				

Evaluation Measure			8A - North of Fair Oaks Avenue to South of Scott Boulevard			8B - South of Scott Boulevard to North of De La Cruz Boulevard				
			Aerial Viaduct (HST Only) – East Alignment	**At Grade**	**Open Trench**	**Aerial Viaduct (HST Only) – West Alignment**	**Aerial Viaduct (HST Only) – East Alignment**	**At Grade (HST Only)**	**Covered Trench/Tunnel (HST Only)**	**Deep Tunnel (HST Only)**
		connections								
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable	Not applicable	Not applicable	Not applicable				
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Nominal width for this option is '50'. Approximately 40% of subsection has existing ROW <90', 15% between 90'-99' and 45% over 100'	Low; Nominal width for this option is 96'. Approximately 40% of subsection has existing ROW <90', 15% between 90'-99' and 45% over 100'	Low; Nominal width for this option is 96'. Approximately 40% of subsection has existing ROW <90', 15% between 90'-99' and 45% over 100'	Low; Approximately 85% of existing ROW is over 100'	Lower than Aerial Viaduct (HST Only) – West Alignment; Approximately 85% of existing ROW is over 100'	Low; Approximately 85% of existing ROW is over 100'	Low; Approximately 85% of existing ROW is over 100'	Low; Possibly some due to ventilation structures
	Properties with access affected	Properties with access affected	None			None				
	Local traffic effects around station	Increase in traffic congestion	Not applicable			Not applicable				
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None			None				
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	0.28	0.28	0.28	None				
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None			None				

Evaluation Measure			8A - North of Fair Oaks Avenue to South of Scott Boulevard			8B - South of Scott Boulevard to North of De La Cruz Boulevard				
			Aerial Viaduct (HST Only) – East Alignment	At Grade	Open Trench	Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment	At Grade (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
Environmental Measures	Cultural resources	Number of historic structures within ultimate ROW	None			None				
		Archeological Sensitivity (identified as present or not)	Present			Present				
	Parklands	Acres of parklands within ultimate ROW	0.06	0.06	0.06	None				
	Agricultural lands	Acres of farmland	Not applicable			Not applicable				
	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=301-500, I=5-10, S<5, P<5	R=301-500, I=5-10, S<5, P<5	R=301-500, I=5-10, S<5, P<5	R=101-200, I<5, S<5	R=101-200, I<5, S<5	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	R=301-500, I=5-10, S<5, P<5	R=301-500, I=5-10, S<5, P<5	R=301-500, I=5-10, S<5, P<5	Lower impacts than At Grade option	Lower impacts than At Grade option	R=61-100, I<5, S<5	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to the ultimate ROW	R=101-200; P<5	R=101-200; P<5	R=101-200; P<5	R=41-60	R=41-60; lower than Aerial Viaduct (HST Only) – West Alignment	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
		Number of scenic roadways that cross the ROW	None			5	5	Lower impacts than Aerial Viaduct and Berm options	Minimal impacts	
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	0%	0%	0%	0%	0%

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Evaluation Measure			8A - North of Fair Oaks Avenue to South of Scott Boulevard			8B - South of Scott Boulevard to North of De La Cruz Boulevard				
			Aerial Viaduct (HST Only) – East Alignment	At Grade	Open Trench	Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment	At Grade (HST Only)	Covered Trench/Tunnel (HST Only)	Deep Tunnel (HST Only)
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	2/15	2/15	2/15	2/8	2/8	2/8	2/8	Lower impacts than other options, depending on the siting of vent structures, tunnel portals, and tunnel depth
Alternative Carried Forward into EIR/EIS			Yes	Yes	No	No	Yes	Yes	No	Yes

Subsection #9 (a)

Length: 3.5 miles Land Use: Urban

North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.54)
This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection,primarily in a tunnel.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

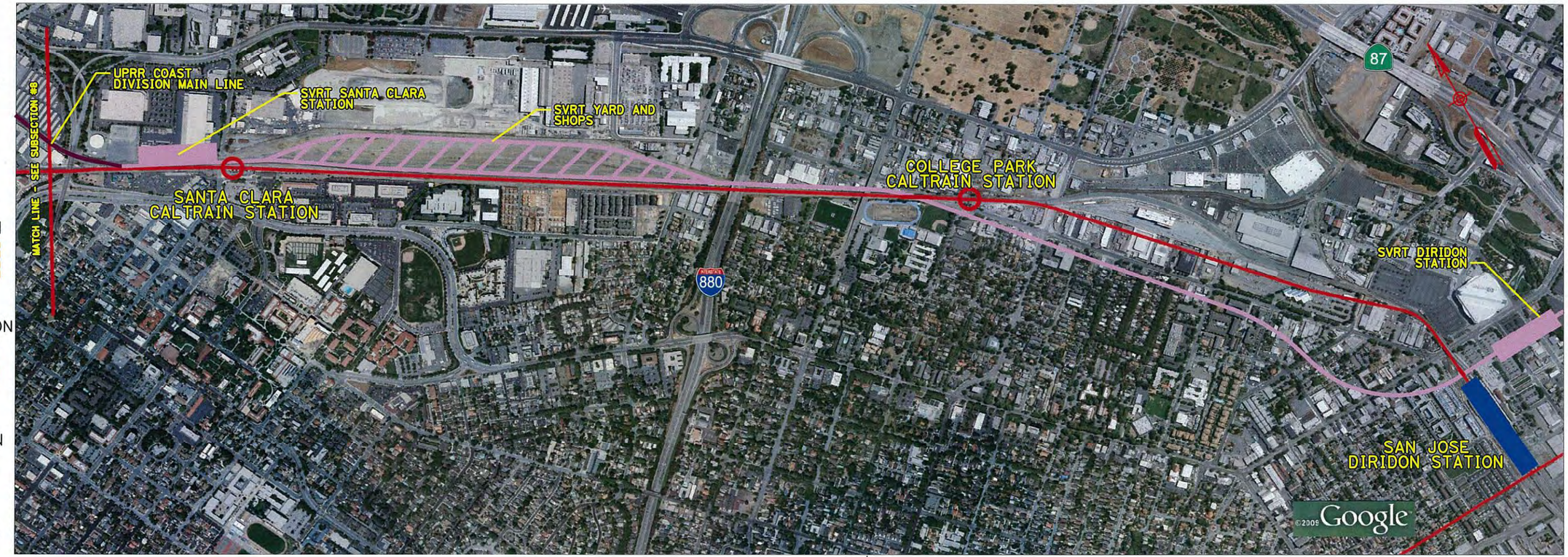
CALTRAIN STATION DESIGN OPTION

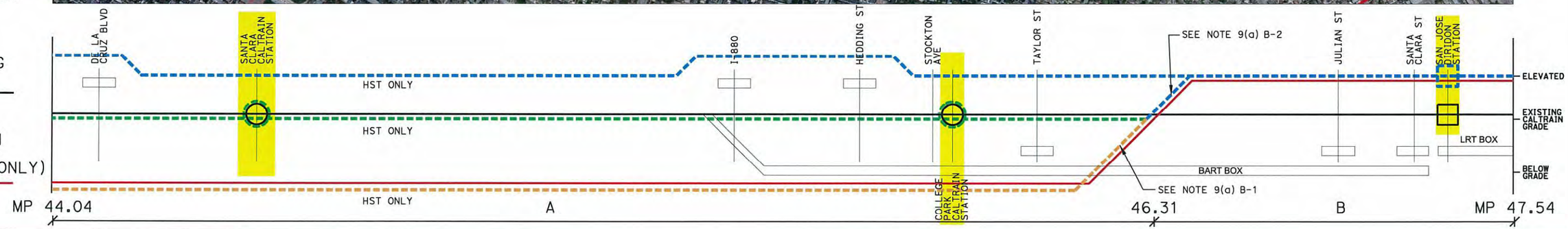
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.10 Subsection 9(a) – San Jose

This section has been modified to read as follows:

Options Considered

- Subsection 9(a)A – North of De La Cruz Boulevard to South of Taylor Street
  - Aerial Viaduct (HST only) – West Alignment
  - Aerial Viaduct (HST only) – East Alignment
  - At Grade (HST only)
  - Covered Trench/Tunnel (HST Only)
  - Deep Tunnel (HST only)
- Subsection 9(a)B – South of Taylor Street to San Jose Diridon station
  - Aerial Viaduct (HST only) – West Alignment
  - Aerial Viaduct (HST only) – East Alignment

Vertical Profile Feasibility Notes

Note	Issue	Description
9(a)B-1	Adjusted	Unable to start vertical curve after Taylor Street due to BART box and elevation difference to clear Julian Street.
9(a)B-2	Adjusted	Unable to start vertical curve after Taylor Street due to elevation difference to clear Julian Street.

Options To Be Carried Forward

The following options have been identified to be carried forward into further engineering and environmental analysis:

- 9(a)A: Aerial Viaduct (HST Only) – East Alignment, Deep Tunnel (HST Only). Under the Aerial Viaduct (HST Only) – East Alignment and Deep Tunnel (HST Only) options, 3 tracks for Caltrain and freight would remain at grade in their existing configuration. The other 2 tracks would either be in the Aerial Viaduct (HST Only) – East Alignment option or in the Deep Tunnel (HST Only) option. The Aerial Viaduct structure would be approximately 100 feet east of the current Caltrain tracks. At West Taylor Street the structure would pass the Caltrain CEMOF facility to the east, curve around two existing buildings, pass over a corner of the HP Pavilion parking lot and realign back to the existing Caltrain alignment at West Santa Clara Street.
- 9(a)B: Aerial Viaduct (HST Only) – East Alignment. In the Aerial Viaduct (HST Only) option, 2 tracks would lead to the HST platforms at San Jose Diridon station, which would be located above the existing passenger rail platforms. The other 3 tracks would remain at grade in their existing configuration leading to the existing rail platforms.

Options Not To Be Carried Forward

- 9(a)A: Aerial Viaduct (HST Only) – West Alignment, At Grade (HST Only), Covered Trench/Tunnel (HST Only). The Aerial Viaduct (HST Only) – West Alignment option would have substantial displacement impacts due to right-of-way acquisition requirements. The Covered Trench/Tunnel option is impracticable due to major constructability issues and requires significant ventilation and life safety features (see the “Options Not Carried Forward” discussion for Subsection 3A for more details). An HST station in Santa Clara was considered and rejected in the Statewide program document.
- 9(a)B: Aerial Viaduct (HST Only) – West Alignment.

Table 4-9
Summary Comparison of Design Options for Subsection 9(a) – San Jose

Evaluation Measure			9(a)A - North of De La Cruz Boulevard to South of Taylor Street					9(a)B - South of Taylor Street to Diridon Station	
			Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment	At Grade (HST Only)	Covered Trench / Tunnel (HST Only)	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment
Design Objectives	Maximize ridership / revenue potential	Travel time	Same for all options					Same for all options	
		Route length	Same for all options					Same for all options	
	Maximize connectivity and accessibility	Intermodal connections	Not applicable					Same for all options	
	Minimize operating and capital costs	Operating and Maintenance (O&M) costs (relative costs associated with different vertical alignment options)	Low	Low	Lowest	Higher than Aerial Viaduct option, due to ventilation, life safety, etc	Higher than Aerial Viaduct option, due to ventilation, life safety, etc	Low	Low
		Capital cost ($ 2009), does not include ROW	158 million	158 million	55 million	592 million	483 million	248 million	248 million
		Acquisition cost of additional ROW	Medium	Medium	Highest	Lowest	Lowest	Medium	Medium
Land Use	Development potential for TOD within walking distance of station	Development potential for TOD within 1/2 mile of station location	Not applicable					Same for all options (San Jose Diridon HST station in this subsection)	
	Consistency with other planning efforts and adopted plans	Qualitative analysis of applicable planning and policy documents	Consistent with adopted plans and policies					Consistent with adopted plans and policies	Consistent with adopted plans and policies
Construct-ability	Constructability, access for construction, within existing transportation ROW (does not include station constructability impacts)	Need for temporary construction easements (TCE)	Medium; Approximately 60% of existing ROW is over 100’	Medium; Approximately 60% of existing ROW is over 100’	Low; Construction would primarily occur within ultimate ROW	Medium; Approximately 60% of existing ROW is over 100’	Low; Construction would primarily occur within ultimate ROW; TCE required at tunnel portal locations	Low; Approximately 85% of existing ROW is over 100’	Low; Approximately 85% of existing ROW is over 100’
	Disruption to existing railroads	Identify existing freight rail and other rail service connections	Not applicable					Not applicable	
	Disruption / relocation of utilities	Identify major utilities requiring relocation	Not applicable					Not applicable	
Disruption to Communities	Displacements	Potential impact on properties due to ultimate ROW requirements and grade separations	Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Lower than Aerial Viaduct (HST Only) – West Alignment; Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Low; Approximately 10% of subsection has existing ROW <90’, 30% is between 90’-99’ and 60% over 100’	Low; Possibly some due to ventilation structures	Low; Approximately 15% of subsection has existing ROW <70’ and 85% is over 100’	Low; Approximately 15% of subsection has existing ROW <70’ and 85% is over 100’

Evaluation Measure			9(a)A - North of De La Cruz Boulevard to South of Taylor Street					9(a)B - South of Taylor Street to Diridon Station	
			Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment	At Grade (HST Only)	Covered Trench / Tunnel (HST Only)	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment
	Properties with access affected	Properties with access affected	None					None	
	Local traffic effects around station	Increase in traffic congestion	Not applicable					Same for all options	
	Local traffic effects along alignment and at grade crossings	Identify streets with permanent loss of traffic lanes due to ultimate ROW requirements and identify traffic effects at grade crossings	None					None	
Environmental Resources	Waterways and wetlands and natural preserves or biologically sensitive habitat areas affected	Waterways (acres of waterways within ultimate ROW)	None					0.11	0.11
		Critical habitat (presence of waterways providing critical habitat for coastal steelhead, identified as Present or None)	None					None	
	Cultural resources	Number of historic structures within ultimate ROW	3	0	3	3	Lower impacts than other options, depending on siting of vent structures and tunnel portals	1	1
		Archeological Sensitivity (identified as present or not)	Present					Present	
	Parklands	Acres of parklands within ultimate ROW	None					0.46 (two facilities)	
	Agricultural lands	Acres of farmland	Not applicable					Not applicable	
Environmental Measures	Noise and Vibration effects on sensitive receivers	Noise: Number of residential (R), institutional (I), medical (M) school (S), and park (P) properties within 300' of ultimate ROW	R=201-300, I<5, S<5, P<5	R=201-300, I<5, S<5, P<5; lower	Lower impacts than Aerial Viaduct option	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	Lower impacts than At Grade option, depending on siting of vent structures and tunnel portals	R=101-200, I=5-10, P=5-10	R=101-200, I=5-10, P=5-10
		Vibration: Number of residential (R), institutional (I), medical (M), school (S), and park (P) properties within 200' of ultimate ROW	Lower impacts than At Grade option	Lower impacts than At Grade option	R=101-200, I<5, S<5	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	Lower impacts than Aerial Viaduct option, depending on siting of vent structures, tunnel portals, and tunnel depth	R=61-100, I<5, P<5	R=61-100, I<5, P<5
	Change in visual / scenic resources	Number of residential (R)and park (P) properties immediately adjacent to	R=41-60	R=41-60; lower than Aerial Viaduct (HST Only) – West Alignment	Lower impacts than Aerial Viaduct option	Minimal impacts	Minimal impacts	R=41-60	R=41-60; lower than Aerial Viaduct (HST Only) – West Alignment

Evaluation Measure			9(a)A - North of De La Cruz Boulevard to South of Taylor Street					9(a)B - South of Taylor Street to Diridon Station	
			Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment	At Grade (HST Only)	Covered Trench / Tunnel (HST Only)	Deep Tunnel (HST Only)	Aerial Viaduct (HST Only) – West Alignment	Aerial Viaduct (HST Only) – East Alignment
		the ultimate ROW							
		Number of scenic roadways that cross the ROW	None					5	5
	Maximize avoidance of areas with geological and soils constraints	Percent of ultimate ROW susceptible to liquefaction	0%	0%	0%	0%	0%	1%	1%
	Maximize avoidance of areas with potential hazardous materials	Number of contaminated properties within ultimate ROW/within 1/4 mile of ultimate ROW	4/26	4/26	4/26	4/26	Lower impacts than other options, depending on the siting of vent structures, tunnel portals, and tunnel depth	2/9	2/9
Alternative Carried Forward into EIR/EIS			No	Yes	Yes	No	Yes	No	No

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Subsection #9 (b)

Length: 3.1 miles Land Use: Urban

North of De La Cruz Boulevard to San Jose Diridon Station (MP. 44.04 to MP. 47.07)
This subsection is located in the Cities of San Jose and Santa Clara. The Caltrain tracks are at-grade and all crossings are grade separated. Besides Caltrain, this subsection is also used by ACE, Capitol Corridor and Amtrak long distance passenger trains and UPRR through freight trains. The future BART extension will also run alongside this subsection, primarily in a tunnel. The access alignment to the San Jose Diridon Station (for HST service) is modified to match the alternative downtown alignment being studied by the Mer-SJ HST Team.

ELEVATED (AERIAL/BERM)

EXISTING CALTRAIN GRADE

BELOW GRADE (TRENCH/TUNNEL)

POTENTIAL CONSTRAINTS

HST STATION DESIGN OPTION

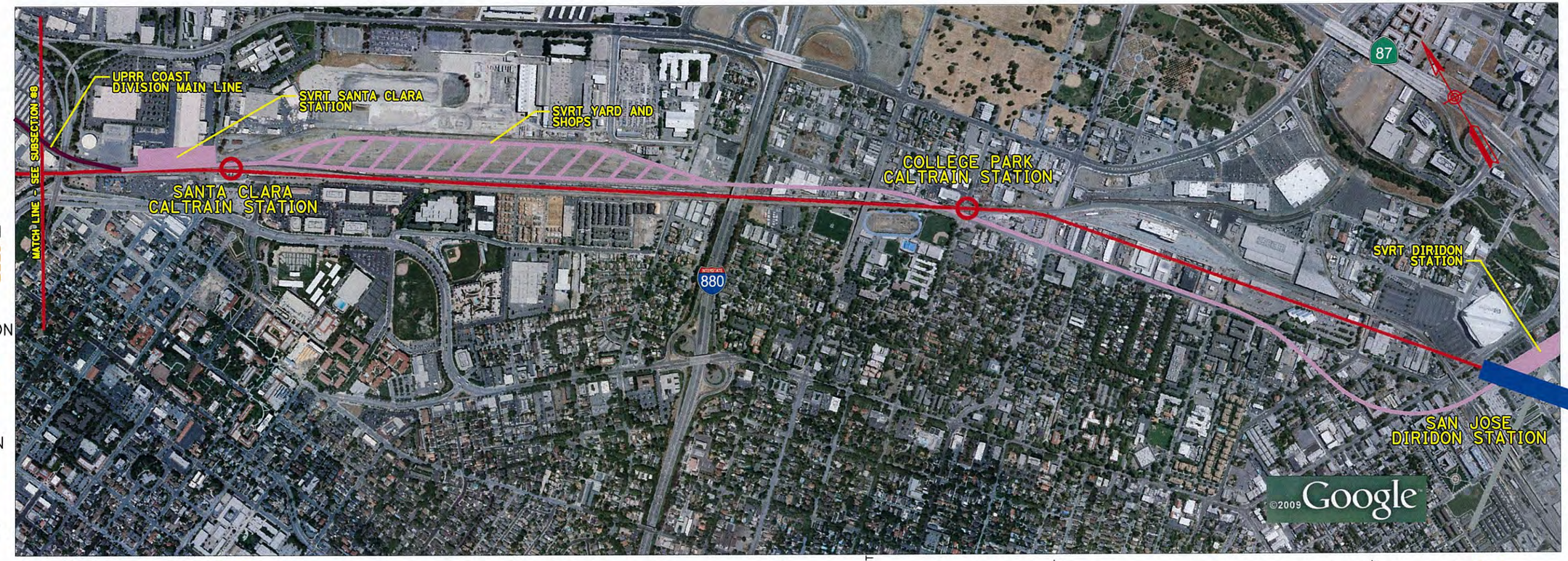
CALTRAIN STATION DESIGN OPTION

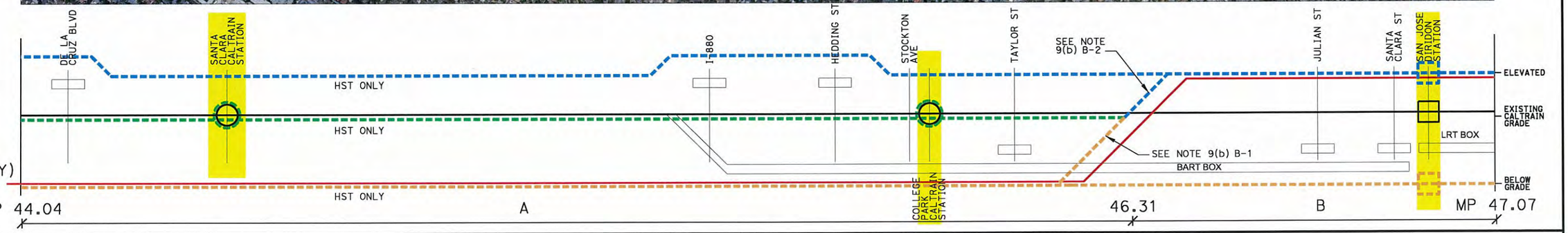
ROADWAY DESIGN OPTION

EXISTING GRADE SEPARATION

EXISTING TRACK

PROGRAM EIR/EIS (REFERENCE ONLY)





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4.3.11 Subsection 9(b) – San Jose

This section has been modified to read as follows:

Options Considered

The Preliminary Alternatives Analysis for San Jose to Merced Section was considering an HST alternative that approaches San Jose Diridon station from the south in a tunnel alignment east of the existing station building. To maintain consistency with the San Jose to Merced Section, Subsection 9(b) was included in this analysis. Subsection 9(b) would have been carried forward in the San Francisco to San Jose Section only if the San Jose to Merced Section alternatives analysis had determined that a tunnel alignment east of the existing station building would be carried forward.

- Subsection 9(b)A – North of De La Cruz Boulevard to South of Taylor Street
    - Deep Tunnel (HST only)
- Subsection 9(b)B – South of Taylor Street to San Jose Diridon station
    - Deep Tunnel (HST only)

Vertical Profile Feasibility Notes

Note	Issue	Description
9(b)B-1	Adjusted	Unable to start vertical curve after Taylor due to BART box and elevation difference to clear Julian St.
9(b)B-2	Adjusted	Unable to start vertical curve after Taylor due to elevation difference to clear Julian St.

Options To Be Carried Forward

None.

Options Not To Be Carried Forward

The San Jose to Merced Section alternative analysis did not carry forward the HST alternative that approached San Jose Diridon station from the south in a tunnel alignment east of the existing station building. Therefore, Subsection 9B would not be studied in the Draft EIR/EIS.

Table 4-10
Summary Comparison of Design Options for Subsection 9(b) – San Jose

No modifications or updates to this Table.

5.0 Analysis Summary and Conclusions

This section has been modified to read as follows:

For convenience, this summary combines the conclusions and recommendations of both the Preliminary Alternatives Analysis Report and the Supplemental Alternatives Analysis Report.

Subsection 0 – San Francisco:

Only Option 0(a)A, in which HST and Caltrain service is proposed at the Transbay and 4th & King locations, has been identified to be carried forward into further engineering and environmental analysis. Option 0(b)A, with which all HST service goes to the Transbay Transit Center and there is no HST service at the 4th & King station, is not practicable and does not meet project purpose and need and objectives due to insufficient capacity. Option 0(c)A, which assumes that all HST service terminates at the 4th & King station, similarly would not provide sufficient capacity and would not reach the Transbay terminal as a San Francisco terminus. Option 0(d)A with which HST service would go to a Beale Street station at Transbay Terminal and also to a 4th & King station is not practicable because of difficulties constructing the tunnel along The Embarcadero and under the Bay Bridge and because it would have extensive impacts to properties and displacements.

Subsection 1 – San Francisco: A combined At Grade and Tunnel 2 Track option has been identified to be carried forward into further engineering and environmental analysis. This option includes a new 2-track tunnel parallel to the existing 2-track Caltrain tunnels 1-4. Caltrain and freight would continue to use the existing Caltrain tracks.

Subsection 2 – Brisbane, South San Francisco, San Bruno and Millbrae: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 2A: At Grade.
- 2B: Berm with tracks partially elevated and roadway crossings partially depressed. A fully elevated option is not practical due to the impacts on freight rail connections to South San Francisco Yard and the Granite Rock/Central Concrete tracks.
- 2C(1): Berm. The San Bruno Grade Separation Project is located in this subsection; the Alternatives Analysis assumes that this project will be constructed.
- 2C(2): Berm, Open Trench. This would be a configuration where 2 or 3 tracks begin to transition to a Berm for a new grade separation at Center Street. At the same time, 1 or 2 tracks would begin to transition to an Open Trench for the lower-level portion of the Millbrae (SFO) HST station.
- 2D: A configuration that leaves 2 or 3 tracks at grade and stacks the 1 or 2 tracks below the existing tracks in a Covered Trench/Tunnel. The HST station would either be below grade or split with one platform at grade and one platform below grade. This configuration would avoid right-of-way impacts at the Millbrae station where there are local plans for a transit-oriented development.

Subsection 3 – Burlingame and San Mateo: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 3A: At Grade, Open Trench.
- 3B-3D: Aerial Viaduct, Open Trench. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench option. The At Grade option was not carried forward in Subsection 3B because it would have extensive impacts to properties and displacements. The Covered Trench/Tunnel option has a greater ROW requirement for construction than the Open Trench option and requires significant ventilation and life safety features. The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration.
- 3E: At Grade.

Subsection 4 – San Mateo, Belmont, San Carlos, and Redwood City: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 4A: Berm with the tracks partially elevated and 25th Avenue partially depressed. The At Grade option is not practical due to the short transition distance between 25th Avenue and 28th Avenue.
- 4B(1): The Berm option would accommodate local plans for transit-oriented development calling for 28th Avenue and 31st Avenue to extend across the Caltrain corridor, and for potential relocation of the Hillsdale Caltrain station approximately ¼ mile north of its present location.
- 4B(2): Aerial Viaduct. The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features. The Covered Trench/Tunnel option has a greater ROW requirement for construction than the Aerial Viaduct option and requires significant ventilation and life safety features.
- 4C: Aerial Viaduct. It should be noted that the recommended profile was developed to satisfy Redwood City's request that Whipple Road remain at its existing elevation. A short trench section may be possible in Downtown Redwood City if the elevation of Whipple Road was modified.
- 4D: The At Grade option allows for a Caltrain and freight connection to the Dumbarton branch and Port of Redwood City spur. The Open Trench option would require converting approximately 3,000 feet of the Dumbarton branch to a trench to accommodate a transition from the Caltrain corridor. The Port of Redwood City spur would have to be converted to a trench (open, partially covered, or completely covered) for approximately 6,000 feet (to the east side of US 101) to accommodate a transition from the Caltrain corridor.

Subsection 5 – Atherton and Menlo Park: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 5A: At Grade. The Open Trench and Covered Trench/Tunnel options would require converting approximately 3,000 feet of the Dumbarton branch to a trench to accommodate a transition from the Caltrain corridor. The Port of Redwood City spur would have to be converted to a trench (open, partially covered, or completely covered) for approximately 6,000 feet (to the east side of US 101) to accommodate a transition from the Caltrain corridor.
- 5B: Aerial Viaduct, Open Trench. The Berm option does not enhance connectivity and mobility as well as an aerial viaduct option or trench option. The Covered Trench/Tunnel option has a greater ROW requirement for construction than the Open Trench option and requires significant ventilation and life safety features. The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major

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constructability issues, lengthy construction schedule, and substantial capital cost features. The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration.

- 5C: At Grade, Open Trench. The Open Trench option would be covered at San Francisquito Creek to minimize impacts on the creek and the El Palo Alto tree.

Subsection 6 – Palo Alto: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 6A: At Grade, Open Trench. The Open Trench option would be covered at San Francisquito Creek to minimize impacts on the creek and the El Palo Alto tree, and partially covered (to the extent necessary) at the Palo Alto Caltrain station to minimize impacts to the historic station. The Berm option does not enhance connectivity and mobility as well as a trench or tunnel option. The Covered Trench/Tunnel option has a greater ROW requirement for construction than the Open Trench option and requires significant ventilation and life safety features. The Deep Tunnel option is impracticable since it would result in critical risks due to ground conditions, have major constructability issues, lengthy construction schedule, and substantial capital cost features. The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration.
- 6B: Aerial Viaduct, Open Trench. Along Alma Street, the Aerial Viaduct option would overhang and Open Trench option would be partially covered to minimize the impacts to traffic lanes.
- 6C: At Grade, Open Trench. Along Alma Street, the Aerial Viaduct option would overhang and Open Trench option would be partially covered to minimize the impacts to traffic lanes.
- 6D: At Grade, Open Trench.

Subsection 7 – Mountain View and Sunnyvale: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 7A: At Grade, Open Trench. Along Central Expressway, the Open Trench option would be partially covered to minimize impacts to traffic lanes. The At Grade option may result in the loss of two traffic lanes on Central Expressway north of Rengstorff Avenue. The Covered Trench/Tunnel option has a greater ROW requirement for construction than the Open Trench option and requires significant ventilation and life safety features. The Hybrid option does not enhance the interoperability between HST and Caltrain and requires significant additional ROW for transitions from the 4-track side-by-side configuration.
- 7B: At Grade, Open Trench. The At Grade option requires moving VTA light rail to a below grade configuration as necessary to remain below the vertical alignment of the HST and Caltrain tracks. The Aerial Viaduct option requires converting the Shoreline Boulevard to an at grade configuration.
- 7C: At Grade, Open Trench. The At Grade option requires moving VTA light rail to a below grade configuration as necessary to remain below the vertical alignment of the HST and Caltrain tracks. The relocation of the VTA LRT would extend to the east side of Central Expressway (eliminating the at-grade LRT crossing). Where the tracks run between Central Expressway and Evelyn Avenue, the Open Trench option would be partially covered to minimize impacts to traffic lanes. The At Grade option may result in loss of one to two traffic lanes on Central Expressway or Evelyn Avenue.
- 7D(1): Aerial Viaduct, Open Trench.
- 7D(2): At Grade, Open Trench.

Subsection 8 – Sunnyvale and Santa Clara: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 8A(1): At Grade. The Open Trench option has a greater ROW requirement for construction than the At Grade option.
- 8A(2): Aerial Viaduct (HST Only) – East Alignment, At Grade. The East Alignment would allow the Aerial Viaduct (HST Only) option to be farther away from the residential neighborhoods on the west side of the rail corridor.
- 8B: Aerial Viaduct (HST Only) – East Alignment , At Grade, Deep Tunnel (HST Only). The East Alignment would allow the Aerial Viaduct (HST Only) option to be farther away from the residential neighborhoods on the west side of the rail corridor. Under the Aerial Viaduct and Deep Tunnel options, 2 tracks for Caltrain would remain at grade in their existing configuration. The other 2 tracks would either be in the Aerial Viaduct option or the Deep Tunnel option.

Subsection 9(a) – Santa Clara and San Jose: The following options have been identified to be carried forward into further engineering and environmental analysis:

- 9(a)A: Aerial Viaduct (HST Only) – East Alignment, Deep Tunnel (HST Only). The East Alignment would allow the Aerial Viaduct (HST Only) option to be farther away from the residential neighborhoods on the west side of the rail corridor.
- 9(a)B: Aerial Viaduct (HST Only) – East Alignment. The East Alignment would allow the Aerial Viaduct (HST Only) option to be farther away from the residential neighborhoods on the west side of the rail corridor. The HST platforms at San Jose Diridon station would be located above the existing passenger rail platforms.

Subsection 9(b) – Santa Clara and San Jose: The Preliminary Alternatives Analysis for San Jose to Merced Section was considering an HST alternative that approaches San Jose Diridon station from the south in a tunnel alignment east of the existing station building. To maintain consistency with the San Jose to Merced Section, Subsection 9(b) was included in the Preliminary Alternatives Analysis. Since the San Jose to Merced Section alternatives analysis has now determined that a tunnel alignment east of the existing station building will not be carried forward, Subsection 9(b) has been dropped from further consideration.

Alternatives to be Carried Forward for Further Engineering and Environmental Analysis

This August 2010 Supplemental AA Report identifies two basic design options to be examined in the Draft EIR/EIS. These two options represent “stitched together” alignments that would result in a four track, fully grade separated railroad serving both HST and Caltrain between Transbay Transit Center and 4th and King in San Francisco and San Jose Diridon Station in San Jose. These design options were developed considering the following goals:

1. **Constructability:** Use uniform structure types that are well known in the rail industry and can be applied uniformly throughout the corridor

2. **Minimize Displacements:** Employ the narrowest track configuration to minimize ROW requirements

3. **Minimize disruption to the Caltrain system during construction:** Use three basic structure typologies (at-grade, aerial and trench) that can be constructed and staged in a way to that allows Caltrain to continue in operation during construction.

4. **Minimizes construction costs:** Develop Design Options A and B to minimize construction costs of the Statewide High Speed Train System while delivering a four track, interoperable, grade separated railroad that an be shared by HST and Caltrain.

5. **Meet community needs:** Address city and public interest in alternatives that would not visually divide communities and are responsive to concerns regarding potential noise and vibration impacts.

In the community meetings there was significant interest in design options (hybrid configurations) that stack two tracks over two tracks in either combinations of tunnels and trenches, or in deep trenches that could also act as tunnels for high speed trains on the lower level and a trench for Caltrain and freight service on the upper level. The perceived advantage of these alternatives was that they had a narrow footprint (66-70 feet wide) and would be appropriate in those areas where the existing Caltrain right of way is particularly narrow. The design team looked into applying this type of solution but found that it had the following shortcomings:

- In order to change from a four-track parallel configuration to the four-track stacked configuration, a 5000-foot long transition segment is required. In this transition segment, the "weaving" structures needed to move two tracks from a side-by-side to a stacked configuration require right-of-way approximately 120-135 feet wide. For each stacked segment, two of these 5000-foot long transition segments are required, one to the north and one to the south of the stacked area. Combined, these two transition segments would create about 2 miles of alignment that would most likely have adverse affects on permanent right of way needs. Operational flexibility on the corridor would be limited in the stacked areas. Trains would be limited to either the Caltrain or HST tracks for the length of the configuration (ranging from 3-6 miles) with no opportunity for connection.

- Constructability would be difficult for the deep trench alternative. It would require a 70-80 foot deep trench to be built for HST at the lower level and then an intermediate floor would need to be built to support the Caltrain and freight trains at the upper level. This would be difficult and very expensive to build.

In most subsections, the Covered Trench/Tunnel and Deep Tunnel options are not recommended for further study. Tunneling and underground construction always carries a number of risks and uncertainties, mainly associated with the inherent variability of the geological and hydrological conditions and mechanical properties of soils in which construction takes place. The most common problems are associated with ground movements and settlements that may occur during construction of underground works as a result of elastic or inelastic relaxation of the ground when excavation relieves in situ pressures or as a result of groundwater lowering. Lowering the groundwater table can result in compaction or consolidation of surface soils. Removal of fines by seepage water or through dewatering wells can also cause settlements. Gross instability and collapse of tunnel face, shaft walls or bottom may cause surface depressions. Hence, ground movement control is a major issue for tunnels and excavations in soil in urban areas, especially if such works are performed below the groundwater table. Where groundwater ranges from four to 18 feet below the ground surface (i.e., presence of a high groundwater table), construction must be water tight to prevent excessive groundwater inflows.

In terms of constructability and the current state of the art, mechanized pressurized face tunneling methods employing an Earth Pressure Balance Tunnel Boring Machine (EPBM) or Slurry Tunnel Boring Machine should be used to the greatest extent possible. Sequential Excavation Methods (SEM) can be used for construction of noncircular cross-section openings (i.e., turnouts and cross passages). Construction methods such as SEM where a positive balancing pressure cannot be continuously applied at the advancing tunnel face will require ground freezing or ground modification techniques such as permeation or jet grouting to control groundwater inflows and limit surface settlement.

The Preliminary Alternatives Analysis Report for the San Jose to Merced Section (June 2010) included an evaluation of potential risks and impacts associated with three different types of the proposed HST San Jose Tunnel/Station alternatives (i.e., "Aerial option", "Deep Mined option" and "Shallow Station/Tunnel or Cut-and-Cover option"). Seven evaluation criteria including 24 potential risk items were considered. Weighting factors between each item were not considered, and only relative degrees of impact of risks among three different options/alternatives for each item have been evaluated. The evaluation result implies that "Deep Mined option" and "Shallow Cut-and-Cover option" carry more "high" risks and less "low" risks than "Aerial option", in particular for the evaluation criteria of "cost and schedule", "constructability" and "geotechnical constraints". More detailed evaluation material regarding tunneling appears in Appendix C of the San Jose to Merced Preliminary Alternatives Analysis Report.

Tables 5-1 and 5-2 present the alternatives identified to be carried forward into the Draft EIR/EIS for further engineering and environmental analysis, which are also summarized in Figures 5-1, 5-2 and 5-3. The letters "A", "B" and "B1" in the table boxes refer to the "stitched together" Design Options A, B, and B1. Design Option A option relies predominantly on at-grade and aerial structure solutions to travel the length of the San Francisco to San Jose corridor. Design Option B and sub-option B1 rely on at-grade, aerial, trench and tunnel design solutions. In the southern part of the corridor (Palo Alto, Mountain View and Sunnyvale), Design Option B alternates between trench, at-grade, and aerial options. Sub-option B1 essentially continues the trench in subsections where Design Option B would bring the four track system back to grade or elevated.

Table 5-1
Design Option A – Subsection Options Carried Forward

City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench/ Tunnel	Two Track Deep Tunnel
San Francisco	0(a)	HST and Caltrain to both Transbay and 4th & King			4th and King		TTC	
	1A	North of Mission Bay Drive to South of 16th Street			A[1]		A	

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City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
	1B-1C	South of 16th Street to North of Cesar Chavez Street			A		A	
	1D-1G	North of Cesar Chavez Street to South Portal Tunnel No. 4			A		A	
South San Francisco	2A	South Portal Tunnel No. 4 to south of Colma Creek			A			
South San Francisco / San Bruno	2B	South of Colma Creek to south of I-380		A				
San Bruno	2C(1)	South of I-380 to south of Angus Avenue		A				
	2C(2)	South of Angus Avenue to south of Center Street		A		A		
Millbrae / Burlingame	2D	South of Center Street to south of Millbrae Avenue			A		A	
Burlingame / San Mateo	3A	South of Millbrae Avenue to south of Mills Creek	A					
	3B	South of Mills Creek to north of Villa Terrace	A					
San Mateo	3C-3D	North of Villa Terrace to north of Hayward Park Station	A					
	3E	North of Hayward Park Station to north of Highway 92			A			
	4A	North of Highway 92 to south of 25th Avenue		A				
	4B(1)	South of 25th Avenue to 42nd Avenue		A				
Belmont / San Carlos	4B(2)	42nd Avenue to south of Cordilleras Creek	A					
Redwood City	4C	South of Cordilleras Creek to north of Woodside Road	A					
San Mateo County (North Fair Oaks)	4D	North of Woodside Road to north of 5th Avenue			A			
	5A	North of 5th Avenue to south of 5th Avenue			A			
Atherton / Menlo Park	5B	South of 5th Avenue to south of Ravenswood Avenue	A					
	5C	South of Ravenswood Avenue to north of San Mateo County/Santa Clara County Line			A			

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City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
Palo Alto	**6A**	North of San Mateo County/Santa Clara County Line to south of Embarcadero Road			**A**			
	6B	South of Embarcadero Road to south of Churchill Avenue	**A**					
	6C	South of Churchill Avenue to north of East Meadow Drive			**A**			
	6D	North of East Meadow Drive to north of Adobe Creek	**A**					
Mountain View	**7A**	North of Adobe Creek to north of Rengstorff Avenue			**A**			
	7B	North of Rengstorff Avenue to north of Stevens Creek			**A**			
	7C	North of Stevens Creek to south of Route 237			**A**			
Sunnyvale / Santa Clara	**7D(1)**	South of Route 237 to north of Mathilda Avenue	**A**					
	7D(2)	North of Mathilda Avenue to north of Fair Oaks Avenue			**A**			
	8A(1)	North of Fair Oaks Avenue to south of Lawrence Expressway			**A**			
	8A(2)	South of Lawrence Expressway to south of Scott Boulevard	**HST Only A**					
Santa Clara	**8B**	South of Scott Boulevard to north of De La Cruz Boulevard	**HST Only A**					
	9A	North of De La Cruz Boulevard to South of Taylor Street	**HST Only A[2]**					
San Jose	**9B**	South of Taylor Street to Diridon Station	**HST Only A**					

1=1A-1G Assumes use of existing Caltrain tunnels

2=9A and 9B an additional aerial alignment was identified during the Preliminary AA review process that moves the horizontal alignment east, away from residential neighborhoods.

San Francisco
Station
Transbay
Transit Center

San Francisco
Station
4th & King

Millbrae (SFO)
Station

Potential
Mid-Peninsula
Station Location
Redwood City

Potential
Mid-Peninsula
Station Location
Palo Alto

Potential
Mid-Peninsula
Station Location
Mountain View

San Jose
Diridon Station

9(a) Option Only

LEGEND:

- AERIAL VIADUCT (HST Only)
- AERIAL VIADUCT/BERM
- AT GRADE
- OPEN TRENCH
- COVERED TRENCH/TUNNEL
- DEEP TUNNEL (HST Only)
- 0 SUBSECTION NUMBER / LIMITS

SAN FRANCISCO TO SAN JOSE SECTION

Figure 5-1

DESIGN OPTION A

Table 5-2
Design Option B and Sub-Option B1 – Subsection Options Carried Forward

City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
San Francisco	0(a)	HST and Caltrain to both Transbay and 4th & King			4th and King		TTC	
	1A	North of Mission Bay Drive to South of 16th Street			B[1]		B	
	1B-1C	South of 16th Street to North of Cesar Chavez Street			B		B	
	1D-1G	North of Cesar Chavez Street to South Portal Tunnel No. 4			B		B	
South San Francisco	2A	South Portal Tunnel No. 4 to south of Colma Creek			B			
South San Francisco / San Bruno	2B	South of Colma Creek to south of I-380		B				
San Bruno	2C(1)	South of I-380 to south of Angus Avenue		B				
	2C(2)	South of Angus Avenue to south of Center Street		B		B		
Millbrae / Burlingame	2D	South of Center Street to south of Millbrae Avenue			B		B	
Burlingame / San Mateo	3A	South of Millbrae Avenue to south of Mills Creek				B		
	3B	South of Mills Creek to north of Villa Terrace				B		
San Mateo	3C-3D	North of Villa Terrace to north of Hayward Park Station				B		
	3E	North of Hayward Park Station to north of Highway 92			B			
	4A	North of Highway 92 to south of 25th Avenue		B				
	4B(1)	South of 25th Avenue to 42nd Avenue		B				
Belmont / San Carlos	4B(2)	42nd Avenue to south of Cordilleras Creek	B					
Redwood City	4C	South of Cordilleras Creek to north of Woodside Road	B					
San Mateo County (North Fair Oaks)	4D	North of Woodside Road to north of 5th Avenue			B			
	5A	North of 5th Avenue to south of 5th			B			

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Federal Railroad Administration

City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
		Avenue						
Atherton / Menlo Park	**5B**	South of 5th Avenue to south of Ravenswood Avenue				**B**		
	5C	South of Ravenswood Avenue to north of San Mateo County/Santa Clara County Line				**B**		
Palo Alto	**6A**	North of San Mateo County/Santa Clara County Line to south of Embarcadero Road				**B**		
	6B	South of Embarcadero Road to south of Churchill Avenue				**B**		
	6C	South of Churchill Avenue to north of East Meadow Drive			**B**	**B1**		
	6D	North of East Meadow Drive to north of Adobe Creek	**B**			**B1**		
Mountain View	**7A**	North of Adobe Creek to north of Rengstorff Avenue			**B**	**B1**		
	7B	North of Rengstorff Avenue to				**B**		

City or Town	Sub-section	Location	Vertical Options Carried Forward					
			Aerial Viaduct	Berm	At Grade	Open Trench	Covered Trench / Tunnel	Two Track Deep Tunnel
		north of Stevens Creek						
	7C	North of Stevens Creek to south of Route 237			**B**	**B1**		
Sunnyvale / Santa Clara	**7D(1)**	South of Route 237 to north of Mathilda Avenue	**B**			**B1**		
	7D(2)	North of Mathilda Avenue to north of Fair Oaks Avenue			**B**	**B1**		
	8A(1)	North of Fair Oaks Avenue to south of Lawrence Expressway			**B**			
	8A(2)	South of Lawrence Expressway to south of Scott Boulevard			**B**			
Santa Clara	**8B**	South of Scott Boulevard to north of De La Cruz Boulevard	**HST Only B**					**HST Only B1**
	9A	North of De La Cruz Boulevard to South of Taylor Street	**HST Only B[2]**					**HST Only B1**
San Jose	**9B**	South of Taylor Street to Diridon Station	**HST Only B**					

1=1A-1G Assumes use of existing Caltrain tunnels

2=9A and 9B an additional aerial alignment was identified during the Preliminary AA process that moves alignment east, away from residential neighborhoods.

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San Francisco
Station
Transbay
Transit Center

San Francisco
Station
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Millbrae (SFO)
Station

Potential
Mid-Peninsula
Station Location
Redwood City

Potential
Mid-Peninsula
Station Location
Palo Alto

Potential
Mid-Peninsula
Station Location
Mountain View

San Jose
Diridon Station

9(a) Option Only

LEGEND:

- AERIAL VIADUCT (HST Only)
- AERIAL VIADUCT/BERM
- AT GRADE
- OPEN TRENCH
- COVERED TRENCH/TUNNEL
- DEEP TUNNEL (HST Only)
- 0 SUBSECTION NUMBER / LIMITS

SAN FRANCISCO TO SAN JOSE SECTION

Figure 5-2

DESIGN OPTION B

San Francisco
Station
Transbay
Transit Center

San Francisco
Station
4th & King

Millbrae (SFO)
Station

Potential
Mid-Peninsula
Station Location
Redwood City

Potential
Mid-Peninsula
Station Location
Palo Alto

Potential
Mid-Peninsula
Station Location
Mountain View

San Jose
Diridon Station

9(a) Option Only

LEGEND:

- AERIAL VIADUCT (HST Only)
- AERIAL VIADUCT/BERM
- AT GRADE
- OPEN TRENCH
- COVERED TRENCH/TUNNEL
- DEEP TUNNEL (HST Only)
- 0 SUBSECTION NUMBER / LIMITS

SAN FRANCISCO TO SAN JOSE SECTION

Figure 5-3

Design Option B1

The Supplemental AA Report recommends that the design and environmental efforts focus on a horizontal track configuration that has Caltrain predominantly operating on the outside two tracks and HST on the inside two tracks (see Figure 5-4). This configuration is recommended primarily because it requires significantly less (approximately 20% less) right of way than having both Caltrain tracks on one side of the corridor (see Figure 5-5). This reduced need for ROW benefit would be particularly significant where Caltrain stations are close together (approximately a mile apart) and there is insufficient distance to narrow the ROW width between stations. This configuration also allows greater flexibility in coordinating schedules and sharing track capacity on the corridor for the reason that it would allow HST trains to overtake other trains in certain areas without crossing opposing rail traffic.

Figure 5-4
Typical Track Configuration to be Carried Forward in the Draft EIR/EIS

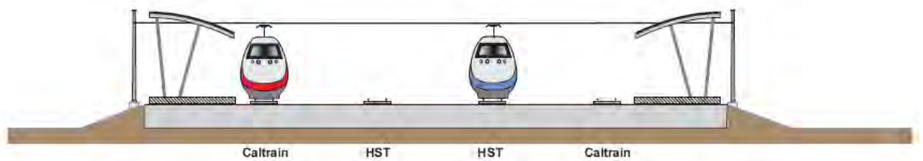
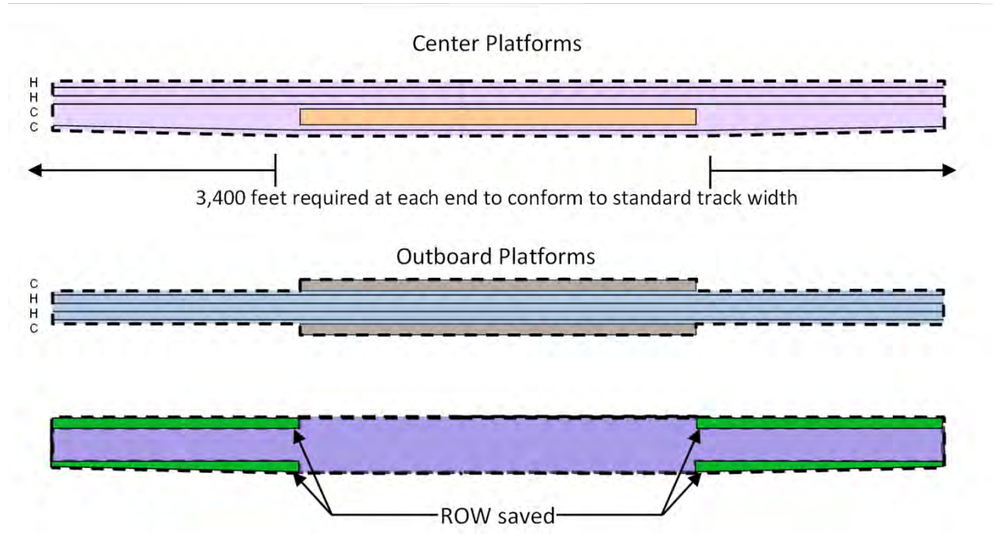


Figure 5-5
Potential ROW Saving with Outboard Platform Track Configuration



Next Steps

The Preliminary and Supplemental AA Reports will inform the Project Description for the Project EIR/EIS. They will also focus the next level of design (15 percent) and inform the analysis of environmental impacts. This ongoing work will provide the Authority, FRA and the communities in the Caltrain corridor a fuller picture of the design options in each subsection and a comprehensive review of the project's benefits and impacts.

As the engineering and environmental work continues, the Authority will continue to meet and engage communities along the San Francisco to San Jose HST section in a discussion about the different alternatives. These activities will inform preparation of the Draft Project EIR/EIS, which is currently scheduled to be released for public comment in December of 2010.

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of Transportation
Federal Railroad
Administration

6.0 References

The following text has been added:

California High Speed Rail Authority, 2010. *San Jose to Merced Section Preliminary Alternatives Analysis Report.*